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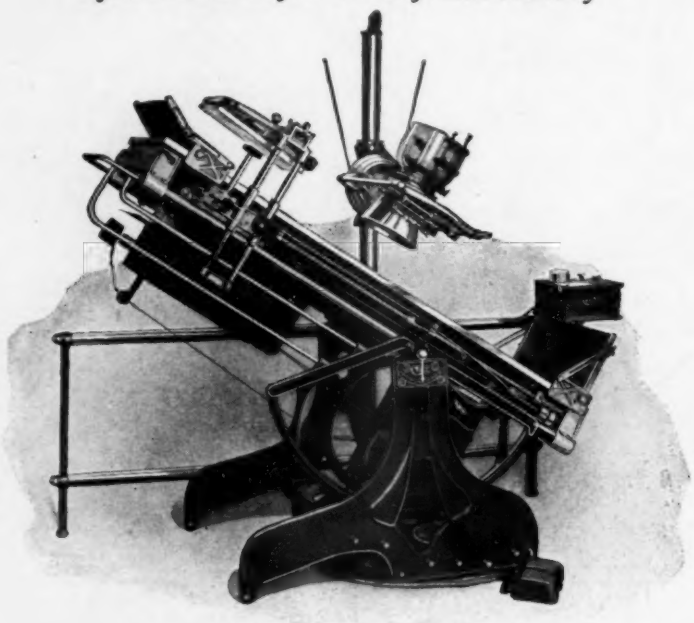

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ROENTGENOGRAPHIC STUDIES OF BRONCHIECTASIS AND LUNG ABSCESS AFTER DIRECT INJECTION OF BISMUTH MIXTURE THROUGH THE BRONCHOSCOPE*

By HENRY L. LYNAH ,M.D.

AND

WILLIAM H. STEWART, M.D.

NEW YORK CITY

DR. STEWART'S first experience in outlining the bronchial tree with bismuth mixture was purely accidental. In October, 1915, while fluoroscoping an old man with an esophageal obstruction, he observed some of the bismuth paste passing from the esophagus directly into the trachea through a fistulous opening, a portion of the paste passing down into the lower bronchi. A roentgenogram was immediately taken. The patient had three or four coughing spells, bringing up particles of bismuth paste, and the following day he seemed none the worse for his experience. The examination was repeated about a week later with no ill effects.

Upon investigation Dr. Stewart found that a number of similar cases had been reported. It occurred to him at that time that with proper precautions the injection of opaque substances into the lung through the bronchoscope could be safely undertaken.

It was evident that advancement along this line was slowly being made, for in 1917 Dr. Sidney Yankauer treated a case of bronchiectasis by direct applications of iodine solution to the diseased area through the bronchoscope. In conjunction with Dr. Willy Meyer and Doctor Yankauer, this patient was carefully watched roentgenographically. Complete recovery occurred.

Between 1915 and 1920 two cases of tracheo-esophageal fistula came under observation in which the main bronchial tree on both sides was outlined by bismuth paste escaping from the esophagus through a fistula into the trachea. Early in 1920, the same phenomena occurred in a case of carcinoma of the esophagus located just above the arch, complicated by laryngeal paralysis; also, in a patient suffering from carcinoma involving the laryngopharynx. In both these cases the bismuth paste entered the trachea beneath the epiglottis, which was imperfectly closed. Repeated roentgen examination of these two patients did not cause any ill effect.

During Dr. Stewart's army experience at Biltmore, N. C., while examining patients

*Read at the Twenty-first Annual Meeting of THE AMERICAN ROENTGEN RAY SOCIETY, Minneapolis, Minn., Sept. 14–17, 1920.

suffering from chronic empyema, he frequently injected bismuth mixtures into an empyemic cavity which had direct communication through a pleuro-pulmonary fistula with a branch bronchus. The bismuth mixture would permeate many of the bronchial branches, be retained long enough to enable him to obtain satisfactory roentgenograms, and then would be expectorated. Such an occurrence, whether accidental or intentional, did not seem seriously to disturb the patient.

The experience mentioned above strengthened his belief that if accidental entrance could occur without danger, injections might be done deliberately and, when combined with roentgen examination, be used for diagnostic purposes.

Dr. C. Jackson, of Philadelphia, during 1918, reported a case before the American Laryngological Association, in which the main bronchi on the right side were outlined roentgenographically; after insufflating dry bismuth through the bronchoscope.

Drs. J. C. Bullowa and C. Gottlieb of New York, in 1919, reported some experimental studies on living animals in which the bronchi had been injected with bismuth and barium mixtures, roentgenographic observations of which brought out details of the bronchial tree heretofore never thought possible. They were able to demonstrate a "wave-like" peristaltic action in the bronchi and trachea.

So far as we are able to ascertain, it was not until early in 1920 that any successful efforts were made to outline roentgenographically lung cavities after the injection of opaque substances through the bronschscope. In May, 1920, Dr. Lynah, of New York, presented a short preliminary report on the subject before the American Laryngological Association; he reported two cases of lung abscess which had been successfully mapped out roentgenographically after the injection, bronchoscopically, of aqueous and oily mixtures of bismuth subcarbonate directly into the area of diseased lung; both these patients have since been repeatedly examined by the authors and are included in the five cases reported in this communication.

Case I. A man of twenty-six years who developed a lung abscess in July, 1919, after having aspirated sea-water while in swimming. He went out too far, became exhausted and went under; was hauled out and by first aid measures soon revived.

One week later he suffered from what was supposed to be bronchopneumonia; there

Fig. 1. Case I. Lung Abscess One Month after First Injection. A. Abscess cavity faintly outlined. B. Remains of bismuth which infiltrated the lung structure at the time of the first injection.

was a great deal of foul expectoration at that time.

Within one month the acute symptoms had subsided, but he continued to expectorate large quantities of pus. He was sent to New Platz, N. Y., with a diagnosis of pulmonary tuberculosis even though no tubercle bacilli were found in the sputum. There he had several hemorrhages; the sputum showed numerous streptococci, he had fever and complained of having a "bubbling" sensation in his right chest. There were several night sweats. In February, 1920, the patient consulted Dr. F. W. Corwin of Newark, N. J., who referred him to Dr. Lynah for bronchoscopic examination.

Roentgenographic studies made by Dr. Corwin showed a definite shadow over the right lower lobe surrounded by a "pus soaked" area of infiltrated lung tissue. The diaphragm was attached and pulled upward. The roentgenologist in his report stated that there was a fluid level and gas bubble in an abscess cavity; this however Dr. Lynah was unable to make out. There was profuse expectoration of foul smelling pus, and the patient stated that he had coughed up as much as would fill two large preserve jars every twenty-four hours.

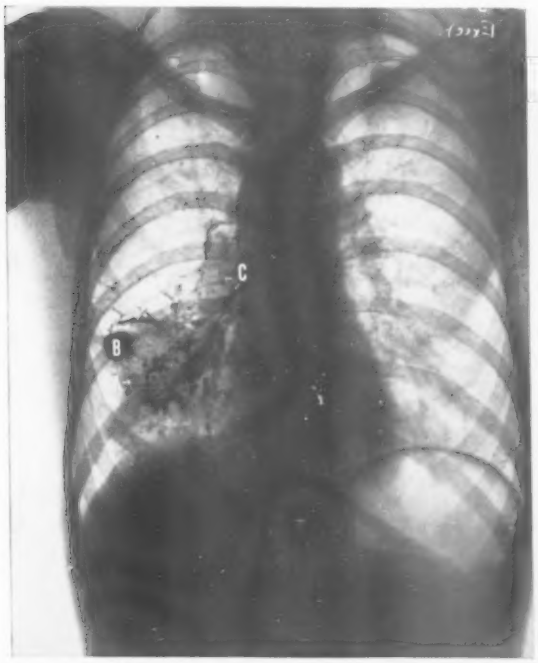


FIG. 2. CASE I. LUNG ABSCESS. IMMEDIATELY AFTER SECOND INJECTION. A. Abscess cavity outlined with bismuth suspended in sweet oil. Small cavities and bronchial branches in involved area also outlined. B. Remains of bismuth infiltrated into lung structure from first injection. C. Main bronchial branches.

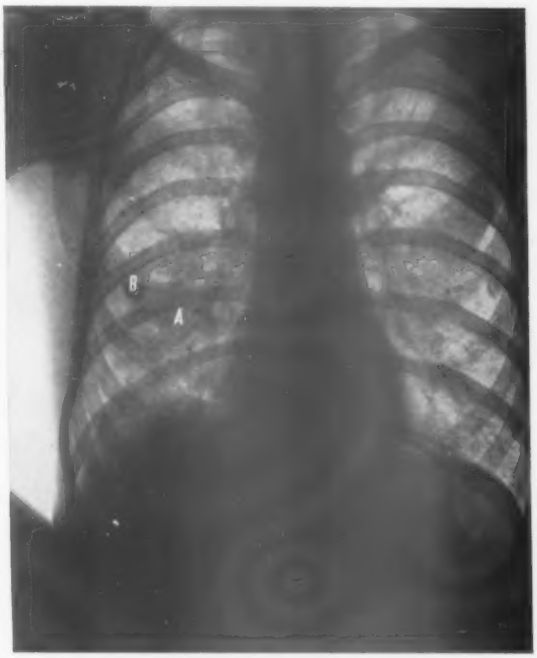


FIG. 3. CASE I. LUNG ABSCESS FIVE MONTHS AFTER INJECTION. A. Area of diseased lung. B. Small amount of bismuth still remaining in lung structure from first injection.

He was bronchoscoped after further study of the roentgenograms. The bronchoscopist noted a profuse discharge of pus pouring out of the mouth of the bronchoscope. It was very foul smelling and blood-tinged. A 7 mm. bronchoscope was introduced so as to make it possible to study and explore the lower lobe branches. After thorough evacuation of the pus-filled bronchi, the superior lobe branch on the right side was examined and found, on coughing, to be free from pus. Pus was noted coming out of the right middle lobe branch, which was directly anterior, but, after this branch was sucked out, and the patient instructed to cough, no pus was in evidence. The lower lobe branches were filled with pus; this was removed by suction and each branch examined in turn and the patient instructed to cough; by this means the branch bronchus from which the pus was coming could be definitely located. The small, but constant ejection of pus with each cough, pointed toward the right anterior branch; this branch was sucked out; however, pus appeared in the mouth of the bronchus with each cough in spite of suction. The long slanting end of the bronchoscope was then insinuated into this branch. It was now noted that there were many granulations present which bled freely. About one ounce of bloody pus was aspirated at this time into a sterile bottle and examined by Dr. George S. Dixon of the New York Eye and Ear Infirmary,

who reported as follows: "The pus removed bronchoscopically from the lung abscess of Mr. F. H. shows a pure culture of Freelander bacillus." This was extremely interesting, for the most virulent cases which we see in the summer caused by swimming about New York harbor are usually due to the Freelander bacillus, one of the colon group. This man had a lung abscess caused by the inspiration of sea-water about New York harbor.

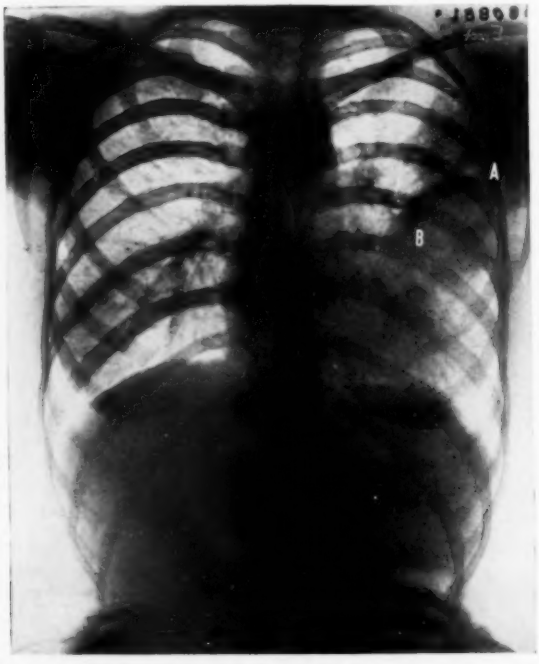


FIG. 4. CASE II. LUNG ABSCESS BEFORE INJECTION. A. Abscess cavity showing fluid level with air bubble above. B. Pus soaked in filtered area of lung structure surrounding the abscess.

For definite lung mapping the abscess cavity was injected the following week with a mixture of bismuth subcarbonate in olive oil (1–2). The right anterior branch was injected around a corner by a specially made curved spiral cannule; 8 c.c. of bismuth mixture was injected slowly so as not to infiltrate the surrounding lung tissue, and within five minutes from this time the patient was flurorscoped by Dr. Charles Gottlieb,, and some very interesting observations made. By fluoroscopy the cavities filled with the opaque mixture could be distinctly seen. Roentgenograms were also taken in all positions and a set of stereoscopic plates made. Within ten minutes the patient was again fluoroscoped and the bismuth mixture was seen coming out of the abscess cavity and flowing upward.

He had not coughed up to this time, for he was breathing as quietly as possible. He did have considerable cough, however, immediately after the removal of the bronchoscope, but the fluoroscopic studies made by Drs. Gottlieb, Corwin and Lynah did not show any bismuth in the bronchi; it was only in the abscess cavities. While the bismuth was coming out of the abscess cavities into the bronchial tree, it was noted that it did not flow downward but upward, and roentgenograms taken at the time showed the middle and superior lobe branches well outlined by the opaque mixture while the lower lobe branches remained free. Shortly after the patient complained of such bubbling that he was compelled to cough, and expectorated about 2 c.c. of the bismuth mixture.

From these observations, Drs. Gottlieb and Lynah agree that probably there is another mechanism besides cough and the action of cilia which causes expulsion of secretions from the tracheo-bronchial tree.

Roentgenograms taken before the injection did not show a definite outline of the abscess.

Another injection of bismuth was made one month later, at which time the roentgenographic studies were made by Dr. Stewart at the Lenox Hill Hospital, who reported as follows:

"Fluoroscopic and roentgenographic examination, to ascertain how long the bismuth would remain in the abscess cavities and also how long it remained in the lobular structure into which it had infiltrated, showed that the bismuth mixture started to make its exit from the bronchial tree within a short time after injection. It remained much longer in the abscess cavities and lobular structures, but eventually disappeared." In abscess cavities it may remain from two weeks to two months, the shadow growing less opaque until it finally disappears. This perhaps ac-

counts for the improvement of the patient and the diminution of the quantity of pus expectorated and the disappearance of odor. The injection of bismuth mixtures, while done for the purpose of outlining the lung in order to locate definitely the abscess cavities, seemed to have a beneficial effect on the patient. There was no odor to the pus expectorated after the second injection; this was so pronounced that the patient noticed it himself and said that he no longer had a foul breath, for the bad smell and taste had disappeared.

This case is still under observation.

FIG. 5. CASE II. LUNG ABSCESS DIRECTLY AFTER INJECTION. A. Abscess cavity outlined with bismuth suspended in sweet oil. B. Bismuth outlining small cavities surrounding large as well as dilated bronchial branches. C. Bismuth infiltrated into lung structure. D. Main bronchial branches.

FIG. 6. CASE II. LUNG ABSCESS TWO MONTHS AFTER INJECTION. A. Remains of abscess cavity. B. Small amount of bismuth still remaining in contracted cavities. C. Remains of bismuth which infiltrated lung structure.

CASE II. A young lady of twenty years was seen in consultation with Drs. Willy Meyer and Richard Jordan. The patient was admitted to the Lenox Hill Hospital and bronchoscoped shortly thereafter. Roentgenograms showed what appeared to be a very large abscess in the left upper lobe well out toward the periphery, which from the "pus soaked" spongy lung structure surrounding it appeared much larger than it really was, and also suggested some pleural involvement.

The patient had had a tonsillectomy performed one week before admission by an expert laryngologist. At the time of admission she was expectorating 250 c.c. of pus every twenty-four hours, and her general condition was poor.

Bronchoscopy with a 7 mm. tube showed pus pouring out of the bronchoscopic tube; all the pus having been sucked out, the left bronchus was entered. There was an edematous bronchial stenosis of the upper lobe orifice with a small opening from which free pus was expelled with each cough; in addition, a membranous plaque was present which also obstructed drainage from the upper lobe. The long slanting end of the 7 mm. tube was gently introduced into the

mouth of the upper lobe orifice separating the edematous stricture; the membranous plaque was removed by suction. After evacuating as well as possible the upper lobe branch, the lower lobe branches were examined but no pus was found in same. The upper lobe branch was again entered and the patient instructed to cough; with each expulsive cough there would be a gush of pus from this branch. The bronchus was apparently

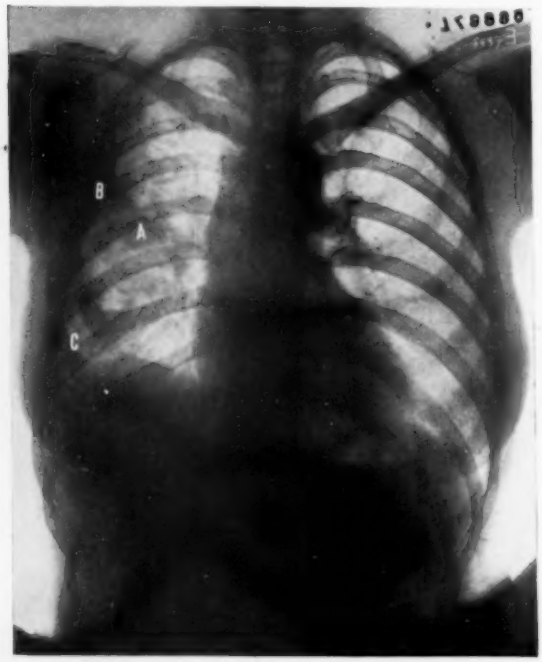


FIG. 7. CASE III. BRONCHIECTASIS BEFORE INJECTION. A. Area of diseased lung with faint evidence of cavitation. B. Resected ribs. Thickened pleura. C. Thickened pleura right diaphragm "hooked up" with adhesions.

draining much more freely since the edematous stricture had been opened. With a 10 inch vacuum the bronchus was once more aspirated and after fifteen minutes the bronchoscopic tube removed.

The following week the patient had improved somewhat, but the amount of pus had not greatly decreased.

Dr. Lynah again bronchoscopically aspirated the upper lobe branch, and then decided to inject the bismuth and oil mixture in order to map out roentgenographically the abscess cavity. With the curved spiral cannula, 8 c.c. of bismuth subcarbonate in olive oil was injected too forcibly, so that some of it squirted out of the spiral and passed downward into the lower lobe branches (leakage out of the spiral will not occur if the bismuth is injected slowly, nor will it infiltrate the lobular structures of the lung). The upper lobe branches of the lung abscess were also injected, the bismuth sticking to the wall of the cavity and thus marking it out. Several smaller abscesses were now noted, whereas in the plate before injection the cavity was interpreted as being very large. The bismuth mixture did not infiltrate the lobular structures in the upper lobe. Stereoscopic plates showed the abscess cavities well anterior and out toward the periphery, while the mass, which had leaked down into the lower lobe branches, was well posterior. A lateral plate taken at this time showed the relations of the upper anterior lobe abscess cavity, which was clearly defined, to the posterior dull opaque fan-shaped areas due to gravitation into the dorsal branch.

The bismuth was expelled from the lung, as in the other patient, within twenty minutes after the injection. As some of the bismuth had leaked downward into the lower lobe branches, it was impossible to state whether or not the bismuth started immediately to be expelled outward, as in the first patient, or whether it had gravitated into the lower lobe branches after it started to be expelled.

The patient was studied from time to time with the fluoroscopic screen and further roentgenograms taken. At the end of one week there was still bismuth present, both in the abscess cavity and in the lower lobe of the lung where no abscess existed; this looked somewhat like an abscess cavity, but was seen roentgenographically as an irregular area of opaque dullness, and did not have the metallic luster of the bismuth in the abscess; this is one of the distinguishing points between infiltration of bismuth into the lobular structure of the lung and bismuth in an abscess cavity.

The patient improved after the injection,

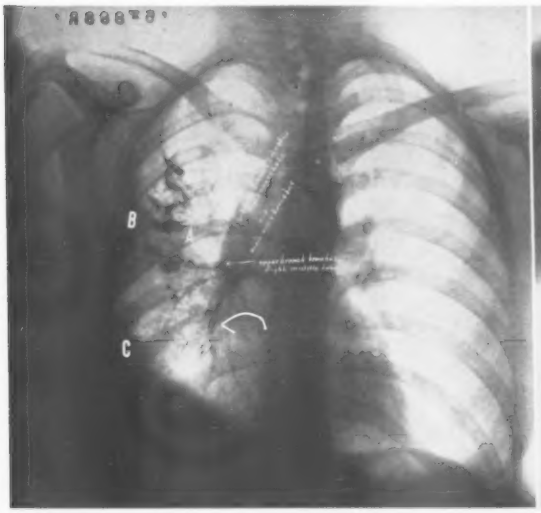


FIG. 8. CASE III. BRONCHIECTASIS IMMEDIATELY AFTER INJECTION. A. Cavities mapped out with bismuth suspended in sweet oil. B. Resected ribs. Thickened pleura. C. Thickened pleura. Right diaphragm "hooked up" with adhesions.

FIG. 9. CASE III. BRONCHIECTASIS SIX WEEKS AFTER INJECTION. A. Involved area of lung free from bismuth. B. Resected ribs. Thickened pleura. C. Thickened pleura, diaphragm caught in mass of adhesions.

in a manner similar to Case I. The pus decreased from her lung, and the amount of measured sputum in twenty-four hours decreased from 250 c.c. to 30 c.c. The odor was decidedly less and the patient's general health improved.

Bismuth was still present in the lung when fluoroscoped ten days after injection, although both shadows were diminishing in density and the lung abscess was apparently clearing up.

The patient suffered no discomforts following two injections of bismuth into her lung. She ate and slept well and had but little cough. She was bronchoscoped twice after the injection and we were not able to recover any of the bismuth by suction, even though it was still present in the lung. At a later bronchoscopic examination there was very little pus recovered by suction and no pus was expelled from the bronchus when the patient was instructed to cough.

The patient is still under observation.

CASE III. A female, S. M., age twenty-five years. On March 26, 1918, she had her tonsils and adenoids removed. Ten days following the operation the patient began coughing

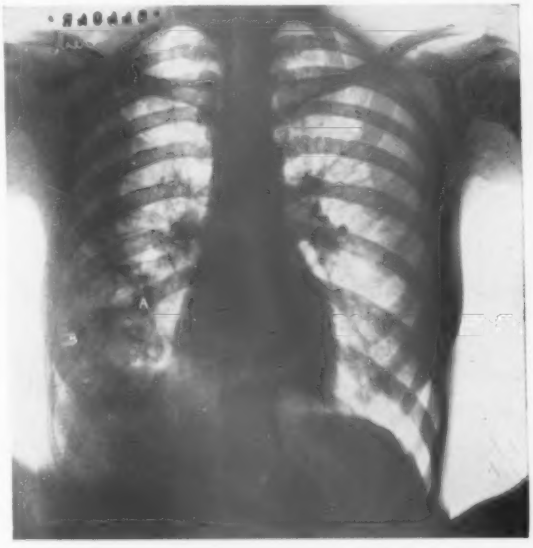


FIG. 10. CASE IV. BRONCHIECTASIS. BEFORE INJECTION. A. Area of cavitation. B. Fixed diaphragm with thickened pleura and bands of adhesions.

up small quantities of foul-smelling sputum, thick and yellowish in character; the amount gradually increased and occasionally the sputum was streaked with blood. There was pain and soreness in the lower part of the chest.

She was operated in May, 1919. Rib re-

section was performed and the cavity Dakinized; no abscess was found. The following September the incision was reopened and the tube placed in the cavity; there was no drainage; very little improvement occurred. In November, 1919, a new incision was made lower down with resection of a rib; a tube was left in the cavity, but no drainage occurred. In January, 1920, the incision was reopened and extended backward. An abscess was opened and a tube left in for drainage, which amounted to four ounces on the first day and two ounces on the second day. The discharge gradually decreased, the tube was removed and the wound healed.

About six weeks later she began coughing and raising foul-smelling sputum again and gradually became worse until she was admitted to the Lenox Hill Hospital on May 17, 1920.

On May 22, 1920, a preliminary fluoroscopic combined with stereo-roentgenographic examination showed evidence of pleuritic thickening involving the upper and middle lobes on the right side; the right diaphragm was partially fixed with adhesions. In the lower portion of the upper right and the upper portion of the middle right lobes there was increased density with here and there evidence of cavitation.

The patient was bronchoscoped on May 25, 1920. Abundant purulent secretion was discharging from the upper lobe; 8 c.c. of a mixture of bismuth subcarbonate in sterile olive oil (1–2) was injected in the upper lobe bronchus; this was followed by a fluoroscopic as well as a stereo-roentgenographic examination which showed that some of the bismuth mixture had reached the diseased area, but not sufficient to map out the cavities satisfactorily.

A roentgen re-examination on June 9th showed much the same condition as reported on May 22d. Most of the bismuth had disappeared.

On July 8th the patient was again broncho-

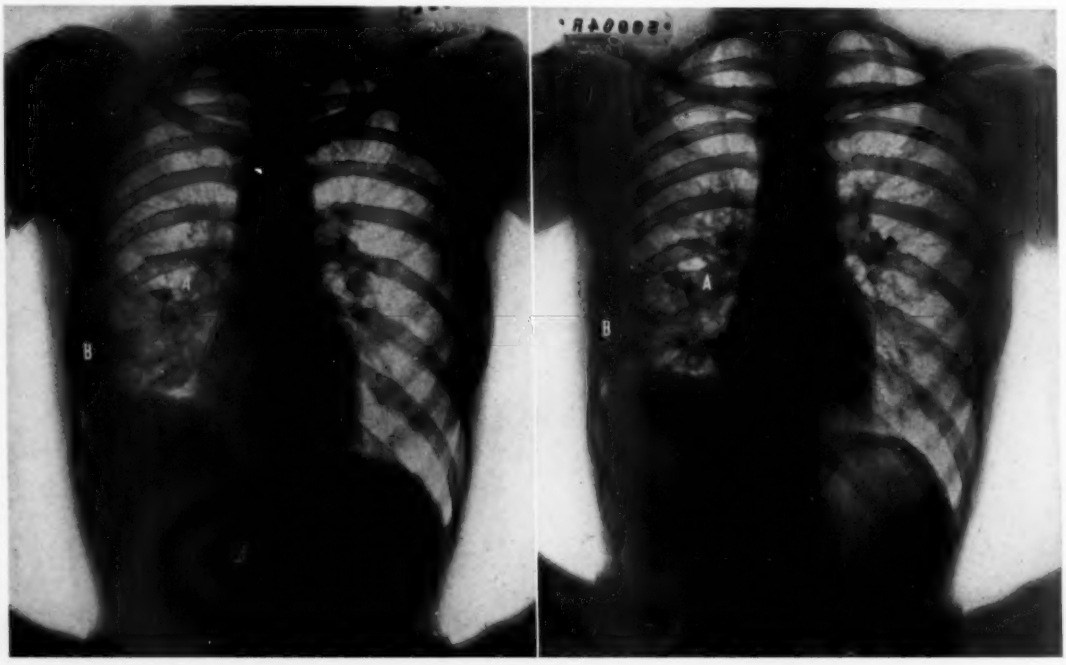


FIG. 11. CASE IV. BRONCHIECTASIS. IMMEDIATELY AFTER INJECTION. A. Area of cavitation outlined with bismuth suspended in sweet oil. B. Thickened pleura with adhesions. Right diaphragm "hooked up" and fixed.

FIG. 12. CASE IV. BRONCHIECTASIS. FOUR MONTHS AFTER INJECTION. A. Area of cavitation. Small amount of bismuth still present. B. Some clearing of lung at right base. Thickened pleura with adhesions. Right diaphragm "hooked up" and fixed.

scoped, the main upper lobe being injected as previously. The stereo-roentgenograms, taken almost immediately after the injection, showed with excellent detail the numerous cavities in the lower portion of the upper and the upper portion of the middle right lobes.

The patient is still under observation and shows continued improvement.

Case IV. A. L., a young girl twenty years

Fig. 13. Case v. Lung Abscess. One Month Before Injection. A. Lung abscess showing fluid level with air bubble above cavity surrounded by pus-soaked infiltrated area of lung structure.

old, was admitted to the Lenox Hill Hospital in June, 1920, with the following history:

Tonsils had been removed two years previously. Following the operation she was taken home in an open car, with considerable exposure. Pneumonia developed; the cough continued, and two weeks later she began expectorating large quantities of foul smelling pus. This condition persisted up to the time of her admission to the hospital.

A preliminary fluoroscopic combined with stereo-roentgenographic examination, on June 19, 1920, showed marked pleuritic thickening over the middle and lower right lobe; the right diaphragm was "hooked up" with adhesions and there was considerable increased density in the middle and lower right with evidence of cavitation, especially in the lower lobe.

June 20, 1920, bronchoscopic examination showed pus coming from the middle and lower right lobes; none from the upper. A mixture of 8 c.c. of bismuth subcarbonate in sterilized olive oil was injected into the bronchi of the middle and lower right.

Roentgen examination, made as soon as possible after the injection, showed the bronchi within the diseased area well outlined, with numerous cavities clearly demonstrated.

When the patient entered the hospital she expectorated 300 to 500 c.c. per day. Since the injection gradual improvement has occurred with marked diminution in the quantity of expectoration.

The patient is still under observation.

Case V. E. E., male, age twenty-four years, entered the Lenox Hill Hospital on June 18, 1920, with following history:

Had tonsils removed June 5, 1920; six days later developed a cough which became productive on about the ninth day. On admittance his chief complaint was cough with expectoration, and pain in the joints.

June 23, 1920, a preliminary roentgen examination was made which revealed a dense triangular area in the lower portion of the upper right lobe; in the center of this pus-soaked, spongy area of infiltrated lung tissue, a fluid level with an air bubble above could be made out, indicating a large abscess.

On June 29th he was bronchoscoped, a 9 mm. tube being used. Pus was seen coming from the right upper lobe bronchus only. About 10 c.c. of bismuth subcarbonate in sterilized olive oil (1–2) was injected into the right upper bronchus; this was followed by roentgen examination which showed the lower bronchus outlined by the injection, very little if any having passed into the diseased area.

He was again bronchoscoped on July 8th. Pus was still obtained from the right upper bronchus which was again injected with bismuth suspension. Fluoroscopy and stereo-roentgenograms showed bismuth outlining the numerous cavities; some of the mixture had infiltrated into the lobular structures well out toward the periphery of the upper portion of the dense area.

The quantity of sputa gradually diminished until July 19th, when it had practically disappeared and the arthritic symptoms had greatly improved.

A stereo-roentgenographic re-examination on July 26th showed gradual disappearance of the bismuth except where it had penetrated the lobular structures.

The patient is still under observation.

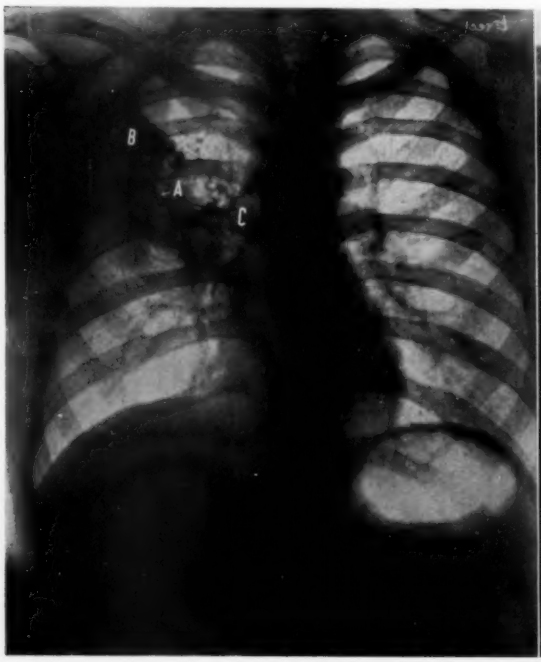


FIG. 14. CASE V. LUNG ABSCESS. DIRECTLY AFTER INJECTION. A. Lung abscess mapped out with bismuth subcarbonate suspended in sweet oil. B. Bismuth infiltrated into lung structure.

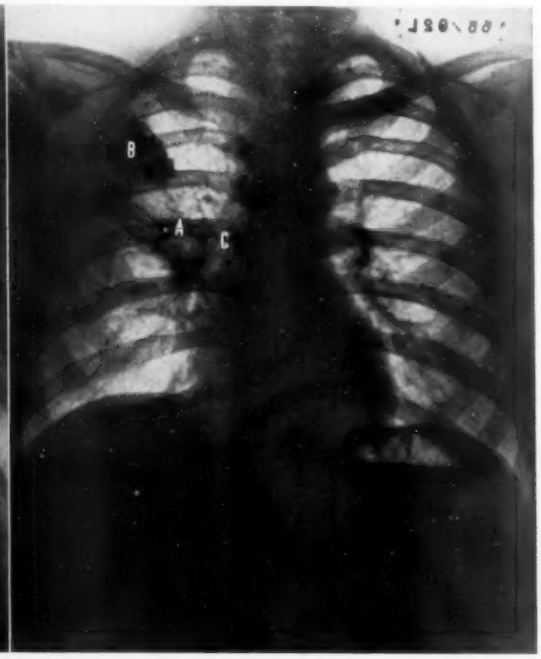


FIG. 15. CASE V. LUNG ABSCESS. THREE WEEKS AFTER INJECTION. A. Remains of cavity. B. Bismuth infiltrated into lung structure. C. Dilated right bronchus.

SUMMARY

1. Bismuth mixtures can be injected into the bronchi and lungs of a living patient without danger.

2. The injection of an opaque substance into the lung of the living patient will open an enormous field of usefulness in the study of cough, the expulsion of substances from the lung, and lung drainage. It will also aid in localizing bronchial strictures in the same manner as in the esophagus. Furthermore, it will be of the greatest aid to the thoracic surgeon by mapping out the abscess cavity in the respective lobe of the lung.

3. A definite lung abscess cavity is seldom seen bronchoscopically. Pus is usually seen coming from a branch bronchus, although the abscess may be well around the corner, and not in that portion of the lung from which the pus is oozing. An injection of bismuth mixture or some other opaque mixture will "clear up" this error.

4. Bismuth, when it enters the abscess cavity, is recognized by its metallic luster, whereas when it is in the lobular lung structure, it is discerned as a dull opaque area. Pus diffuses and soaks the lobular structure in a manner similar to bismuth; this often

makes the involved area appear many times larger than it really is.

5. The bismuth mixture injected in these patients was 8 c.c. of bismuth subcarbonate in pure olive oil (1–2). The mixture is rendered sterile by boiling before injection.

6. The injection should be made slowly and not with a "squirt," or else the roentgenographic observations may be spoiled by bismuth soaking the lung structure surrounding the diseased area.

7. It seems from these preliminary studies that cough and action of cilia are not the only means of expelling secretions.

8. While bismuth mixtures were originally injected for the purpose of lung mapping in cases of lung abscess cavities, they seem to have been of therapeutic benefit to the five patients upon whom they were tried. So far the procedure has done no harm.

9. While the fluoroscopic examination is important, stereo-roentgenographic examination is the best means of localizing the cavitations.

10. Experience has shown that the roentgen examination should be made almost immediately after the removal of the bronchoscope, otherwise the patient, in a fit of coughing, will remove much of the bismuth from the involved lung.

DISCUSSION

Dr. David R. Bowen. In the slide that was shown of Dr. Jackson's case the remarkable thing was that this plate was made on the fluoroscope with double screen. We hurried the patient to the stereoscope, and there was nothing there, although it could not have been more than fifteen minutes.

Dr. W. F. Manges. I should like to ask Dr. Stewart why he uses so much bismuth, why the mixture is so concentrated. This is a rather big field for study, and I wonder if it would not be well to advise a bit of caution. It seems to me that one should first be sure that he has the proper facilities for taking care of emergencies. Unless one has the association of a competent bronchoscopist, the procedure had better not be started. I think those of us who are in laboratories where there are efficient bronchoscopists, where there is every means for taking care of emergencies, ought to do everything we can to continue and work with Dr. Stewart alone these lines, and see if the end results are going to be right.

It seems to me that since a foreign body in the lung tissue must be removed sooner or later, for eventually the foreign body in the lung is apt to set up a suppurating process, I do not see why bismuth should not act as a foreign body in the lung tissue that has not been previously walled off by fibrous tissue—why it should not become a foreign body because of its metallic properties.

Dr. W. C. Hill. I should like to ask Dr. Stewart whether, in any of these cases where the bismuth was retained a month, there were any symptoms of bismuth poison, not nitrate poisoning, but bismuth poisoning. I know of two deaths from bismuth poisoning and I saw another case, a child, who was closely following the course of the others when I saw it, and advised evacuation of the bismuth.

Dr. G. E. Pfahler. I would like to compliment Dr. Stewart on his brilliant work, as well as the daring which led him to undertake it, but I would like to ask whether there is any benefit to the patient, or whether the benefits are purely diagnostic—whether the method has a therapeutic value to the patient other than simply to outline the abscess cavity for the benefit of the surgeon. We must, after all, consider how much good this is going to do the patient.

Dr. P. M. Hickey. I, too, would like to compliment Dr. Stewart on this pioneer work, and would like to take up the cudgel in its behalf. It is quite possible for a foreign body to remain in the lung without setting up irritation. I have two plates in the exhibit room—one a child who had a peanut in the lung for five weeks, and the other for two weeks. When I introduced the bronchoscope, there was no appearance of secretion. The bronchus was perfectly clear.

During this discussion, I have been thinking over some work I knew about some years ago, when a friend of mine injected the trachea and bronchi daily with a laryngeal syringe for

chronic cough. The solution he used was olive oil and guaiacol. He used it in considerable quantities, and it seemed to be a soothing application.

If the bronchoscopy is done by a competent man, the injection of a small amount of sterile solution in the bronchus, I believe, can have no deleterious effects. It is certainly a very brilliant thing to be able to map out the bronchi in the way it has been done. It would, of course, be easier to collapse the lung and get rid of the abscess in that way, but this new method is important in that one is able to demonstrate in these cases the exact extent of the pathology present. It seems to me that, from a theoretical standpoint, there can be no danger to the patient, inasmuch as you use only a local anesthetic.

Dr. F. F. Borzell. It seems to me that there is considerable weight to Dr. Manges' statements. It might be true that when the bismuth is first injected, it is sterile; and I do not doubt that many of our foreign bodies which are inhaled are sterile at the time of inhalation; but with the bronchioles being constantly subjected to infection from without no foreign body would remain in the bronchiole for any length of time without becoming infected, resulting in the varied pathology one sees with any other infected foreign body in the bronchial system.

Dr. James T. Case. Are there any further discussions? If not, I should like to speak of my own experience in this matter. I have known of two deaths following the actual inspiration of barium-mixed food into the larynx, in one case the mixture being only barium and water. This was a case of carcinoma of the esophagus. One case I have especially in mind was one in which Dr. L. L. McArthur injected a bronchial cyst which had a pharyngeal opening. In the injection, a fairly large quantity of the bismuth mixture was used, the injection being done about five o'clock in the afternoon. During the night, the patient had a sudden fit of coughing. The next morning, she was brought to the *x*-ray room to see what had happened. The entire bronchial tree was distinctly filled with bismuth. Following this, the patient had a most violent case of multiple abscess of the lung, and it was a miracle that she lived through it; but she finally made a complete recovery.

Dr. W. H. Stewart. I expected, of course, a certain amount of criticism, and am very glad to have had the discussion entered into as it was. I always have a great regard for the opinion of Dr. Manges, as I believe he is one of the most conservative men in this particular line, and I have to voice his ideas, that it must not be taken up promiscuously, that the work must be done by an expert bronchoscopist, but it can be done absolutely without danger. It is really remarkable, gentlemen, that every one of the five cases reported this evening, wrote Dr. Lynah and asked for a re-examination, because they had received so much benefit from the bismuth injection. There is no question of the therapeutic value of this procedure to the patient. In one case the amount of expectoration was reduced from 500 c.c. in twenty-four hours to 30 c.c. in twenty-four hours. Whether or not a cure will be effected, we are unable to say at the present time, nor are we able to say whether the bismuth which infiltrated the lung structures will cause any further trouble. It has not up to the present; it is gradually disappearing and does not seem to act as a foreign body. I believe it will gradually disappear without any inconvenience. We have observed these cases for only six months; all are under close observation, however, and will be watched carefully.

In regard to the opaque solution—Dr. Lynah tried thorium and other mixtures of like character. He found that bismuth subcarbonate and sweet-oil was *the one* non-irritating mixture; it does not seem to trouble the patient in the least.

Dr. Hill asked regarding bismuth poisoning. I can emphatically state that never, in any way, has there been any evidence whatsoever of bismuth poisoning. As stated before, the patients were all benefited to such an extent that each and every one wrote a letter asking to come back to the Hospital for another injection.

With regard to the benefit to the patient, as asked by Dr. Pfahler, there seemed first to be the diagnostic element, and second, the therapeutic effect. Dr. Lynah questions in his own mind whether the benefit is due to the bismuth

in the lung or whether to the fact that the bronchoscopy opened up the bronchi and allowed a free drainage of the lung. At the present time I believe both elements enter into it. Dr. Borzell, I think I have answered in regard to the retention.

With regard to Dr. Case's experience, it is impossible for me to say why this case should have such untoward effects. It may be that the injection was not made with the same precautions which Dr. Lynah uses in making his injections.

I am very sorry that Dr. Lynah is not here. He is a brilliant speaker, and would be better able to defend his position than I, who only take up the *x*-ray side of the question.

THE BUCKY DIAPHRAGM PRINCIPLE APPLIED TO RADIOGRAPHY OF THE SPINE*

By H. E. POTTER, M.D.

CHICAGO, ILLINOIS

MY object in presenting this short paper on radiography of the spine is not for the sake of reviewing the well-known pathologic conditions in which *x*-rays have proven of diagnostic value, or of calling attention to their differential features, but to set before you for your criticism a series of technical results made by a method with which you are familiar in theory but which, as far as I am able to learn, has not been used in a practical routine manner outside of our laboratory.

Those who are not familiar with the work we have been trying to do in adapting the Bucky diaphragm principle to practical radiography may be referred to the article published in the June number of our JOURNAL. This takes up the construction of a parallel grid which moves between patient and plate during an exposure and serves to absorb a large number of the obnoxious scattered rays, while its simple movement serves to neutralize its own shadow. Attention was called to the larger number of scattered rays present in penetrating the deeper portions of the body, such as the abdominal or pelvic region. For this reason, in combination with one other, we have chosen to exemplify first the results obtainable in radiography of the spine. The other reason is that with crude apparatus of our own construction the element of time in grid movement has prevented the extremely rapid exposures desired in working with the moving viscera. We may say that since February of this year all

FIG. 1. FRACTURED LAMINA OF FIRST LUMBAR. COMPRESSION OF SECOND.

*Read at the Twenty-first Annual Meeting of THE AMERICAN ROENTGEN RAY SOCIETY, Minneapolis, Minn., Sept. 14–17, 1920.

our spine cases have been handled by this method, and in the last months all of the kidney and gall-bladder cases.

The net results of the method are to give us plates which show a heightened contrast between bony and other structures, and a greater clearness in the more delicate structures of the spine complex in as large a section of the spine as is desired. It necessarily follows that the gross lesions can be studied more comprehensively and the minor or beginning lesions brought to light with greater certainty. In the latter years we have all become used to seeing the most critical radiographs of the extremity bones, and we shall all admit, when we stop to think, that in the most important spine cases the diagnosis is often made possible by the last 10 or 20 per cent in the technical excellence of the plates. We believe that shortly the Bucky diaphragm method will form a basis for obtaining results on the spine which are entirely comparable to those obtained on the extremities, and at this time we wish to record systematically a number of respects in which the method has materially helped us in our diagnostic efforts:

1. In the recognition of tuberculosis and metastatic carcinoma. Early tuberculosis and beginning metastasis are deservedly subjects which give the roentgenologist great concern on account of their clinical significance and general difficulty of recognition. The large comprehensive plates have more than once yielded unexpected information a few inches higher or lower than was clinically suspected. Slight or suspicious changes in any anterior portion of the vertebral body

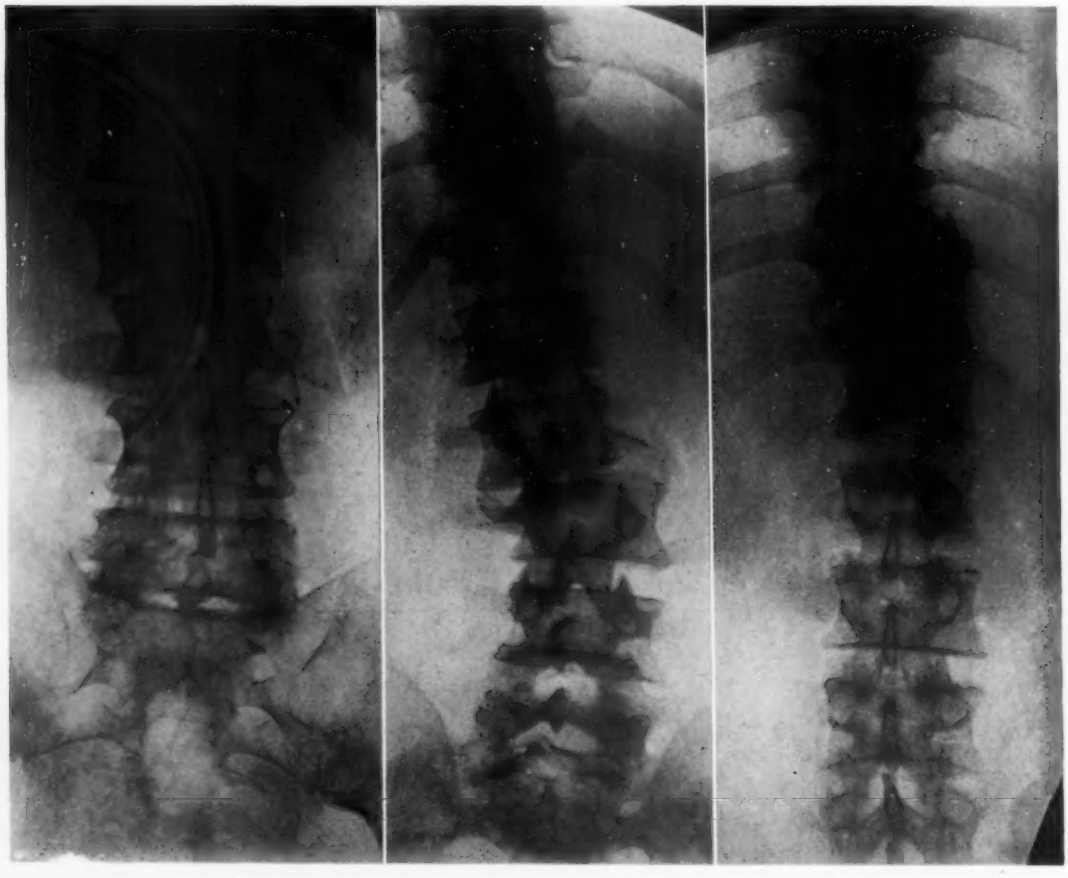
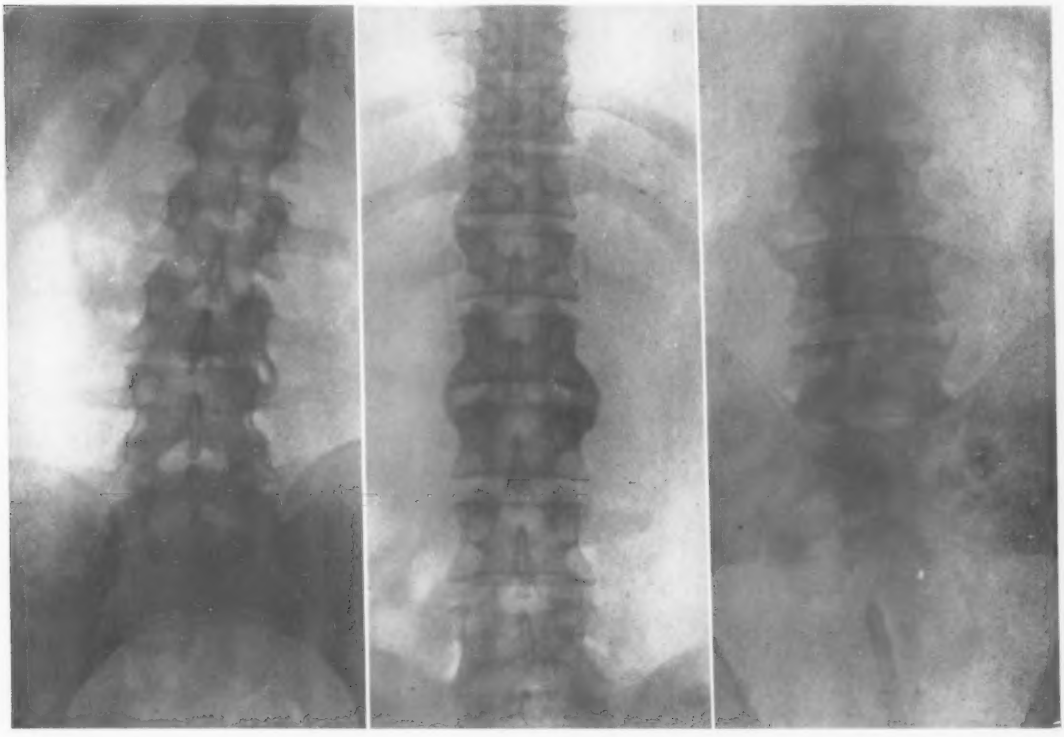


FIG. 2. A FEW FRACTURED SPINES SHOWING LARGE SCOPE OF EXPLORATION WITHOUT SACRIFICE OF RADIOGRAPHIC QUALITY.

have been followed up by plates projected obliquely or laterally so as to bring the suspicious point into profile, with the result that the suspicion was turned into a diagnosis.

2. This ability to obtain critical plates in oblique or lateral positions has many times resulted in the graphic measurement of slight impactions to the bodies of vertebrae brae. Vertebrae lying above the diaphragmatic line have a peculiar anatomic relationship, in that on either side the air-filled lungs easily transmit rays which flood into the central plate area before the denser spinal structures have been fully recorded. It was one of our surprises to see how the plates with the Bucky apparatus prevented this



A B C

FIG. 3. DEEP OSSEOUS RADIOGRAPHY FOR DISEASE.

A. Tuberculosis with Bony Reaction. B. Typhoid Spine, after eight months. C. Metastatic carcinoma of prostatic origin. Hypertrophic Arthritis.

where such could scarcely be known to exist by any simple or stereoscopic series made from in front. The general value of lateral spines has been brought out in this Society by Hickey and others. The Bucky diaphragm method offers us the easiest means of obtaining results in this most difficult technique.

3. This filtering method makes possible much more critical study of antero-posterior plates of the middle and lower dorsal vertesource of fog and gave us the same clean results obtainable elsewhere.

4. In the study of the pelvic structures the method has been gratifying on account of our ability to obtain a comprehensive plate of the whole pelvis without losing the details about either the hip-joints or the sacro-iliac region. Fractures of one portion of the pelvic ring are so often associated with a second fracture elsewhere in the pelvis that comprehensive plates should be re-

lied upon for the whole of the truth, particularly if radiographic detail can thus be preserved.

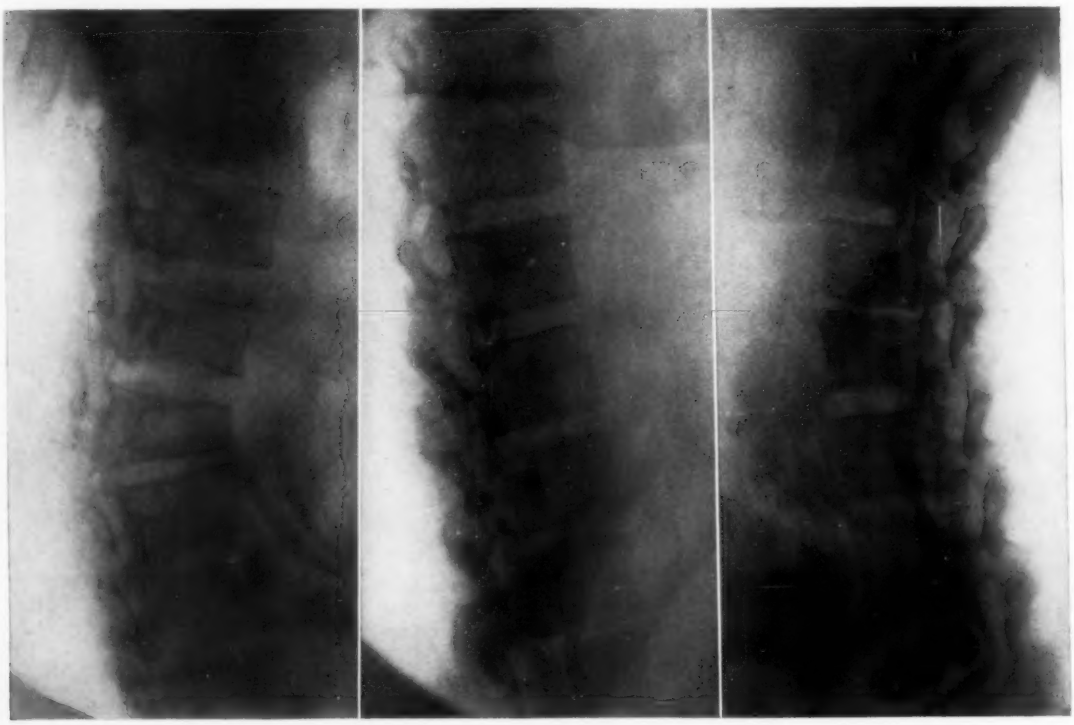
5. In cases of old minor injuries to the lumbar spine, associated with traumatic or other arthritis, or with callus formation, when structures of the pedicle and not the bodies have been fractured, etc., nothing short of the most excellent plates by this or any other method can lead one to a justifiable diagnosis, fully protected and set aside from the anatomic architectural peculiarities common in the lower spine.

These in brief are the advantages which we believe have been observable in our routine work. There is one disadvantage which can be seen in an inspection of any series of our plates. The osseous structures are slightly enlarged because of the increased distance between patient and plate, and when a large focus tube is used the hard lines lose somewhat of their sharpness. This disadvantage can be corrected somewhat by the use of fine focus Coolidge tubes, increasing the tube distance and using a grid of greater fineness and less depth.

DISCUSSION

Dr. B. C. Darling. The opportunity to make the large-sized plate seems to me is a distinct advantage. There has always been a limitation, for in order to get satisfactory plates, we had to use a small cone. By this method, we will be able to use more 11 x 14 and 14 x 17 plates, and we will get much finer detail by this method. The hardest thing to get is thus made easier, and in this way our diagnostic ability will be improved.

I had the pleasure of seeing this apparatus in Dr. Potter's office the other day, and he cer-



A B C

Fig. 4. A Few Lateral, Semi-Lateral or Near-Lateral Spines.

A. Lateral from Figure 3-A. B. Normal lateral for scope. C. True lateral in compression fracture.

tainly has something worth while. He has something that, if mechanically perfected, will be of great value.

Dr. P. M. Hickey. Last summer I had the pleasure of visiting Dr. Potter's office, and seeing a demonstration of how this diaphragm works, and the plates which he has I have never seen equaled, either in number or quality. It is a wonderful thing that roentgenography of these parts of the body, which heretofore has been so difficult, can be brought out with such a wealth of detail.

Dr. Isaac Gerber. I would like to know whether Dr. Potter has found that the use of this diaphragm was interfered with at all in double screen and film work, or whether all of his exposures are made on straight plates or films.

Dr. H. E. Potter (Closing). The first exposures were made with plates entirely, and this seemed pretty hard on the thirty milliampere Coolidge tubes, so all the rest of the exposures have been made with double screen film, which is very much easier on the tube and simpler in technique. The double screen greatly aids instead of interferes with the method.

PNEUMOPERITONEUM AS AN AID IN THE DIFFERENTIAL DIAGNOSIS OF DISEASES OF THE LEFT HALF OF THE ABDOMEN*

By A. F. TYLER, B. Sc., M.D., F. A. C. P.

OMAHA, NEBRASKA

SINCE this paper is part of a symposium on the use of gas in the peritoneal cavity for diagnostic purposes, I am definitely limited in my discussion to the use of this method as an aid in the diagnosis of diseases of the left half of the abdomen.

Because of the fact that many cases complaining of vague symptoms on the left half of the abdomen present themselves for examination, it occurred to me when I began using this method of diagnosis that such aid might be of considerable use in clearing up this type of obscure cases, so that it has been my custom when I am unable definitely to locate pathology in the left half of the abdomen by the usual physical examination and the opaque meal examination of the gastro-intestinal tract, to employ pneumoperitoneum as a further method of investigation. We have been happily rewarded in many of these obscure cases, a few of which will be mentioned in the body of the present paper.

In reviewing my experience with pneumoperitoneum it has occurred to me that the greatest percentage of cases in which it has been definitely helpful have been those with some form of left-sided pathology. In order that we may lay proper foundation for pathological discussion, let us review for a moment the anatomy of the left half of the abdomen in relationship to findings demonstrable by penumoperitoneum. When the abdomen is filled with gas, it is possible to see clearly the outline of the diaphragm stretched across from the center to the left ribs and above this, of course, the lung in the chest cavity. Below it can easily be demonstrated that the spleen, and in many cases even the pedicle of the spleen, can be readily seen. Near the central portion of the left half of the abdomen can be seen the left kidney in toto. In some cases the left lobe of the liver can be visualized together with the tail of the pancreas. In other cases one will see a band extending across from the left parietal

*Read at the Twenty-first Annual Meeting of The American Roentgen Ray Society, Minneapolis, Minn., Sept. 14–17, 1920.

wall of the abdomen over toward the center, which is only the mesenteric attachment of the splenic flexure of the colon. One must be careful that this is not interpreted as pathological. Having these essential anatomical points in mind, it is then not difficult to determine what is pathological.

Patients frequently present themselves for examination complaining chiefly of colic in the left side which on investigation may prove to be renal or ureteral in type or perhaps colonic in origin. They will complain of an indefinite dragging or pulling sensation which is worse in the erect position and is relieved by lying on the back or on the left side. We are compelled in these cases then, to differentiate between diseases of the kidney, of the left colon, of the spleen, of the pancreas, of the left lobe of the liver and retroperitoneal new growth. In the colon we must differentiate between spastic or ulcerative colitis, adhesions, diverticula and new growths. In the kidney, we must differentiate between stone, pyelitis, tuberculosis, hydronephrosis, new growth, supernumerary kidney, ureteral plug or kink. In the spleen, we must differentiate between the different leukemias, enlargement from malaria, syphilis, hemolytic icterus or Banti's disease and perisplenic adhesions. In the pancreas we must differentiate between cyst and pancreatitis. The left lobe of the liver must be differentiated from the pancreas, the spleen and the kidney. We may further find adhesions of the various organs one to the other or to the parietal peritoneum. We may, in some cases, find a retroperitoneal new growth, such as a large retroperitoneal sarcoma recently demonstrated.

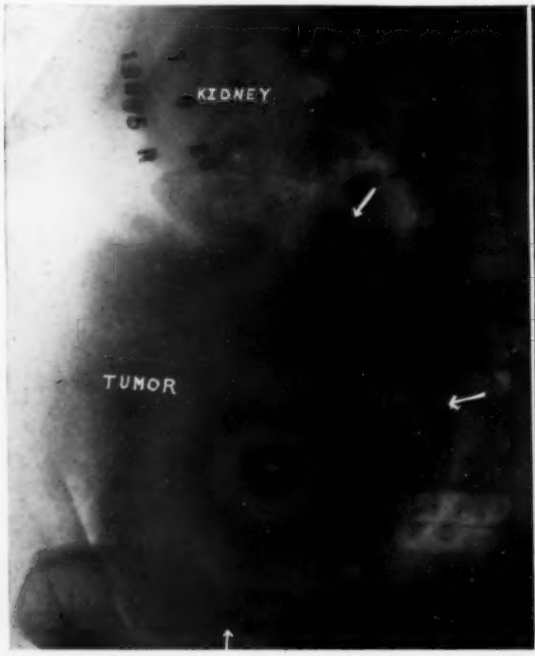


FIG. 1. CASE NO. 13965.—LARGE RETROPERITONEAL TUMOR WITH KIDNEY SHOWING ABOVE AND DISTINCT FROM THE MASS. Proven at operation to be sarcoma.

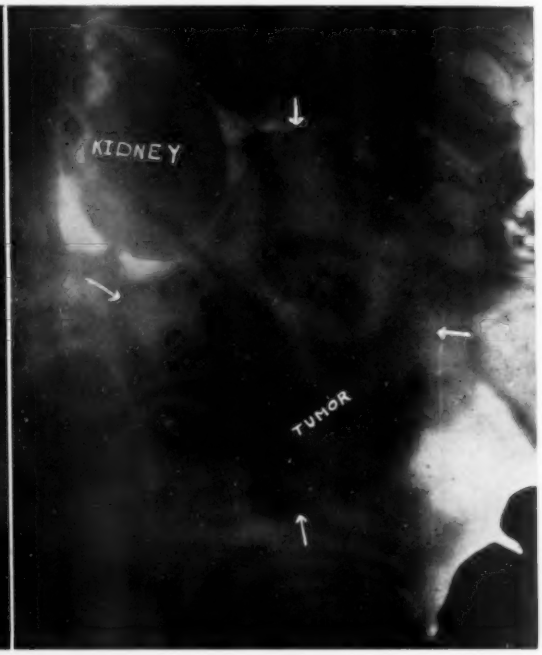


FIG. 2. CASE NO. 13965.—AN OBLIQUE VIEW OF THE SAME PATIENT AS SHOWN IN FIGURE 1, SHOWING THE KIDNEY SEPARATE FROM THE MASS.

In speaking of the differential diagnosis in these various conditions, it is my thought that this differential diagnosis cannot be complete in any case without thorough physical examination, including the *x*-ray examination and the different laboratory tests, together with catheterization of the ureter and other methods usually employed for eliminating or confirming diagnosis; so that in my

presentation of this subject, I take it for granted that all of these different methods are being employed along with pneumoperitoneum, as Case and others have shown that diverticula of the left half of the colon are not infrequent and when carefully searched for are quite readily demonstrated by the usual opaque meal and similar methods of examining the gastro-intestinal tract. As a rule the spastic or ulcerative colon can be demonstrated roentgenologically in the same manner. New growths in the left half of the colon are readily demonstrated by the opaque method. Stone in the left kidney is demonstrated without the use of pneumoperitoneum; but in some cases there is a question as to whether the shadow is really a kidney stone or a calcareous mesenteric gland, and pneumoperitoneum will help us to differentiate, especially when catheterization of the ureter is impossible. Hydronephrosis can readily be demonstrated by injection of gas into the peritoneal cavity, as well as new growths involving the kidney, or retroperitoneal space. Different types of enlarged spleen can be demonstrated by pneumoperitoneum, but must be differentiated by the complete blood count and different laboratory methods. Cysts of the pancreas can be positively proved by pneumoperitoneum better than by any other method. Adhesions to the various organs can be actually visualized by the injection of gas into the peritoneal cavity, clearing up many obscure cases.

FIG. 3. CASE NO. 13285.—A DENSE BAND OF ADHESIONS STRETCHED ACROSS FROM THE COLON TO THE LEFT SIDE OF THE PARIETAL PERITONEUM. On inspiration, the spleen presses down against the band, as shown in the cut. On expiration the spleen moves away from it.

FIG. 4. CASE NO. 12880.—LARGE CYSTIC OVARY, ACCOMPANIED BY MULTIPLE FIBROID TUMORS OF THE UTERUS. PROVEN AT OPERATION.

CASES

CASE 13844: Mrs J. M. B., age thirty-three years.

History.—When the patient was twelve years old she had an attack of bilious fever with jaundice. For seven years she has had pain in the left upper quadrant of the abdomen, which radiates to the back and varies in intensity. She has abdominal distension with gaseous eructations, nausea, but no vomiting and no jaundice.

Physical Examination.—There was a palpable tender mass in the left upper quadrant of the abdomen and slight tenderness in the right upper quadrant.

Roentgen Examination.—This revealed a large soft tissue shadow in the left upper quadrant which has the contour of a kidney.

Pneumoperitoneum proves that the shadow is the left kidney, the spleen being normal in size. There are perisplenic adhesions from the spleen to the diaphragm. The stomach is normal in shape, size and position, empty in six hours. The duodenum is normal. The appendix has been previously removed. The cecum and colon are normal in contour, low, but freely movable.

Diagnosis.—Enlarged left kidney; perisplenic adhesions.

CASE 13440: Miss A. D., age thirty-four years.

History.—For five years patient has been having attacks of abdominal distress, which usually last several weeks, characterized by a feeling of fullness or pressure in the epigastrium and in the left side of the abdomen, extending into the back.

Physical Examination revealed a definite tenderness in the lower right quadrant of the abdomen. Examination otherwise negative.

Roentgen Examination.—The stomach is normal in shape, size and position; empty in six hours. The duodenum shows spasm. The appendix has been previously removed. The cecum and colon are normal in contour and freely movable.

Pneumoperitoneum shows adhesions extending from the left parietal peritoneum across to the greater curvature of the stomach.

Diagnosis.—Perigastric adhesions involving the greater curvature.

CASE 12846: Miss J. G., age twenty-four years.

History.—Patient complains of splashing in the stomach accompanied by pain and vomiting. She was examined by me in March, 1918, at which time a diagnosis of chronic appendicitis was made. This was followed immediately by an appendectomy. In July, 1918, a gastro-enterostomy was done. She has not been well since.

Physical Examination.—Patient was of the enteroptotic type. There was dullness in both apices of the lungs with râles in the left apex and left axilla.

Roentgen Examination shows the opaque meal passing through the gastro-enterostomy opening. The chest shows increase in both hila. Peri-bronchial infiltration well up in both apices. Multiple areas of consolidation in the left upper lobe.

Pneumoperitoneum shows a few adhesions to the abdominal wall at the scar. The shadows of both kidneys are visible. Folds of soft spleen, the uterus, tubes and ovaries are demonstrated.

Diagnosis.—Pulmonary tuberculosis. Abdominal adhesions.

CASE 12355: Mrs. G. H., age forty-five years.

History.—Patient has been constipated for many years. For the past ten years she has had a tender point a little to the right and below the umbilicus. She now has constant pain which radiates to the right thigh and to the back, but it is never very severe.

Physical Examination.—Negative except for general abdominal tenderness with the maximum point one inch to the right of the umbilicus.

Roentgen Examination.—The stomach is normal in shape, size and position; eight ounce residue at five hours. The duodenum is normal. The cecum is not freely movable. The colon is normal and freely movable. The appendix is not visualized.

Pneumoperitoneum shows adhesions extending from the left side of the colon near the splenic flexure over to the parietal peritoneum near the costal arch.

CASE 13346: Mrs. F. H., age twenty-nine years.

History.—One year ago the patient had her appendix removed. Two years prior to her operation she had indigestion and pain

in the epigastrium with occasional vomiting. Since the operation, she has had a dull gnawing pain in the right upper quadrant. This pain is relieved by lying down. There is a feeling of fullness after meals.

Physical Examination shows marked tenderness in the right upper quadrant of the abdomen.

Roentgen Examination.—Filling defect on the lesser curve near the pylorus, probably spasm, no tender point; empty in five hours. The duodenum is normal.

Pneumoperitoneum shows a band of adhesions to the colon near the splenic flexure, against which the spleen is pressed on deep inspiration. A band of adhesions from the scar in the right iliac fossa to the head of the cecum is also demonstrated.

FIG. 5. CASE NO. 12846.—SPLEEN SHOWING TYPICAL FOLDS FREQUENTLY NOTICED AT POSTMORTEM EXAMINATION IN A SOFT FLABBY SPLEEN.

FIG. 6. CASE NO. 133440.—ARROWS POINT TO BANDS OF ADHESIONS EXTENDING ACROSS FROM THE GREATER CURVATURE OF THE STOMACH TO THE LEFT PARIETAL PERITONEUM.

CASE 12973: Mrs. T. E. A., age forty-one years.

History.—Three months previous to examination the patient noticed that the abdomen was growing larger. This gradually increased until the time of the examination. At the time of the examination the enlargement extended up under the right ribs.

Physical Findings revealed a large uterus which nearly filled the entire abdomen. The mass was smooth except for several nodules on the upper anterior aspect.

Pneumoperitoneum shows a fibroid tumor of the uterus plus pregnancy. One month later: Fetus is not visualized, but fluid in the uterus is demonstrated.

CASE: Miss M. E. Age nineteen years.

History.—About two years ago patient began to have pain and swelling in feet and arms which was worse at night. She had a cough and pain in the chest, and night sweats once in a while. She was so weak at times that she could not walk upstairs.

Roentgen Examination.—Peribronchial infiltration well out in both lungs. Both sides of the diaphragm move freely.

Pneumoperitoneum shows the liver, both kidneys, tubes, uterus and left ovary normal

in size and position. No abdominal adhesions. Cyst of the right ovary.

Diagnosis.—Cystic right ovary.

CASE: Mr. J. C., age forty-nine years.

History.—About one year ago patient felt pain in left side and afterwards, due to curiosity, would feel his side and had pain on pressure. Later he felt a mass in the left side, which has continued to enlarge until its contour can be seen on inspection.

Physical Examination.—A large mass in the left upper quadrant of the abdomen which is painful to pressure and movable. Large tumor in the left side of the abdomen, clinically hydronephrosis. Large smooth mass extending beyond the median line to the right and continuous with the kidney shadow.

Pneumoperitoneum.—Movement of fluid in the sac visualized. Stone in left ureter just back of the bladder. Probably hydronephrosis.

Diagnosis.—Ureteral calculus.

Operative Findings.—Large retroperitoneal sac containing urine, attached to the lower pole of the left kidney which lay to the right of the median line. Ureter not connected to sac.

CASE: Mr. J. H., age twenty-four years.

History.—Patient first noticed swelling of the abdomen accompanied by pain in the small of the back and around the umbilicus, especially at night when lying on his side. During the past week he has had a slight cough and two profuse night sweats.

Physical Examination.—Dullness of both apices posteriorly from the scapula down. Abdominal distention and umbilical hernia present.

Roentgen Examination.—A small amount of fluid in the left pleural cavity posteriorly.

Pneumoperitoneum showed adhesive peritonitis with ascites, probably tuberculous. Only a small amount of gas could be injected as the needle entered a pocket. The patient complained of pain when very little gas had been injected.

Diagnosis.—Tubercular peritonitis.

CASE: Mr. P. S., age sixty-eight years.

History.—The patient had the prostate gland removed in 1918 and says stones were imbedded in it. He recovered from this operation and was in good condition for some time. Six months later he began having painful urination and passed large amounts of gravel and had colic pains in the urethra. He passed nearly one hundred stones through the urethra and had some removed from a pocket in the urethra apparently from a dilatation behind a stricture. He has lately noticed severe pain from a few minutes to a half hour after urination.

Pneumoperitoneum.—Patient could not pass catheter because of swollen urethra. One large bladder stone visualized and several smaller ones.

Diagnosis.—Recurrent stones in the bladder. Proved at operation.

CASE: Mrs. C. E. R., age thirty-seven years.

History.—Three years previous the patient had a lump removed from the right breast and one year later a second operation was performed. She has been having attacks of pain in the right side for several years which she thought were pleurisy. The past two weeks she has been getting short of breath but has very little pain.

Physical Examination.—Left pleura markedly thickened. Friction rub on the right side at the junction of the sternum. Breath sounds diminished over the entire left chest.

Roentgen Examination.—Fibrosis with calcified glands extending well out in the right lung. Free excursion of the diaphragm, on the right side. The left lung is radiopaque below the level of the third rib anteriorly. Several round shadows one half inch in diameter are seen in both upper lobes.

Pneumoperitoneum.—Effusion of the left chest. Fluid in the peritoneal cavity which is easily demonstrated. No adhesions, no carcinoma masses demonstrable.

Diagnosis.—Peritoneal tuberculosis.

THE USE OF CO_2 IN PNEUMOPERITONEUM*

By WALTER C. ALVAREZ, M.D.

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SAN FRANCISCO, CALIFORNIA

A YEAR ago, when I began experimenting with pneumoperitoneum, it seemed to me that it would never come into general use unless some way were found of relieving the patient's discomfort immediately after the exposures were made. I felt that the technique would have to be modified in some way so that we could do the work in the office and not in the hospital. Some studies on the absorption of gas from the intestinal cavity had made me acquainted with the fact that CO_2 is absorbed much more rapidly than oxygen. In July, 1919, Dr. Taylor and I injected the preitoneal cavities of a number of rabbits with CO_2 and found that it was absorbed in a few minutes. After convincing ourselves that this gas was as harmless as oxygen we started using it on patients in the office. We found that whereas oxygen often remains in the abdomen in sufficient amounts to cause distress for four days after injection, the CO_2 in no instance remained over half an hour. Ordinarily the patient was relieved of tension in twenty-five minutes.

Dr. Stewart has stated in a recent article that he has tried to make the procedure suitable for office practice by withdrawing the gas through a trocar after the plates are taken. My experience with these patients makes me very doubtful whether many of them would be willing to submit to a second puncture while they are in pain. Moreover, I would rather not make another wound, although my experience with patients who have been operated upon after inflation is in accordance with that of others who have found no sign of damage. In only one case did I see a light strand of omentum adhering to the scar. Another objection to deflation is that it is hard to get all the gas out, and unless this is done completely the patient is going to remain uneasy.

TECHNIQUE

The introduction of the gas is simplicity itself. I use as a measuring bag the rubber cuff that comes with a sphygmomanometer. This holds about a liter. It is connected with the CO_2 tank and with the needle. The air in the tubing should be washed out with CO_2 because the nitrogen in it will remain in the abdomen for 10 days or more. No attempt need be made to sterilize the gas. The needle is sterilized and then thrust through a small spot which has been painted with iodine. I think there is no need for using novocain unless a very large trocar is employed. I use a needle with a caliber slightly larger than that of a lumbar puncture needle. I always clear it first by injecting a few drops of sterile salt solution. The injection is made generally at a point in the middle of the left rectus near the navel. I find it hard to get the patients to take enough of the gas. It is easy with old women who have lost weight and who have flaccid abdominal walls, but it is very hard with muscular men. I make it a routine to give a quarter of a grain of morphin a half hour before the injection. This unfortunately often produces nausea and vomiting later, but it seems the lesser of two evils because one never can tell which patients are going to complain bitterly. Even with the morphin, some do complain of pain, particularly in the right shoulder. Others do not complain of much pain but break out into a cold sweat and seem to be greatly distressed mentally. Others again have paid very little attention to the procedure, and one man got off the table and went out to lunch with me.

*Read at the Twenty-first Annual Meeting of THE AMERICAN ROENTGEN RAY SOCIETY, Minneapolis, Minn., Sept. 14–17, 1920.

I think the best evidence that the operation is not a terrible one is the fact that two of my patients, who did not take quite enough gas the first time, volunteered to have the work repeated.

The only disadvantage that I can see to the CO_2 technique is that one must work rapidly if a number of plates are to be secured. We almost always take first a 14 x 17 plate with the patient lying prone. This is developed immediately so that any special points of interest can be focused on in other plates. It is very helpful when the patient has not much gas in his abdomen to rotate him slightly so that the right side is a little higher for the gall-bladder plates and the left side a little higher for the spleen plates. In this way one makes the most of the gas that is there.

I made a few attempts to use mixtures of oxygen and CO_2, hoping that I might slow down the deflation somewhat, but I promptly gave this up because all the disadvantages of oxygen were retained without sufficient compensatory advantages from the CO_2.

Just a word as to the usefulness of the method. If it were not for the distress to the patient one would like to have a set of these beautiful and instructive plates on every individual who comes with intra-abdominal troubles. Unfortunately, however, the procedure is so alarming and distressing to many patients that I do not believe it can ever be used as a routine. I have found it of most help in the diagnosis of gall-bladder disease, especially in the early stages. I believe that daily we are slipping up on the diagnosis of early cholecystitis. We should be helping these people before they develop more definite symptoms, before they get stones and before they suffer irreparable damage to the liver and pancreas. One of the remarkable things about this technique is that it opens up a clear space between the liver and the kidney. Normally, the bowel should drop down out of this space; and in a number of cases in which it did not do that, operation showed the expected adhesions and the expected gall-bladder disease.

In this way I have been able to help a number of women who otherwise would have gone on suffering, because I would not have had the courage to advise operation in the absence of most of the classical signs of cholecystitis. Although some of the thickened gall-bladders without stones show up very clearly on these plates, it is most disappointing that others do not. I have here to-day a plate which fails to show any gall-bladder shadow although it does show a stone which gave symptoms for twenty-five years. To be sure, operation showed that the wall of the gall-bladder in this case was still thin. Moreover, in spite of repeated attacks of inflammation there were no adhesions to the colon. In other cases it was hard to be sure of the disease in the gall-bladder, even at operation. The wall was not definitely thickened, the bile was sterile, there were only a few adhesions to the duodenum and a large gland on the cystic duct. Nevertheless the pathologist reported small abscesses, full of bacteria, and the patient got well after the cholecystectomy. I think these observations must keep us humble, and must make us admit that the roentgen ray diagnosis of early cholecystitis will often be impossible and always difficult and uncertain.

In spite of these disappointments I still feel that the gas technique is going to be very useful. When the history and other findings point strongly to cholecystitis, and when a series of plates, taken in the usual way, leave the question undecided, I practically always resort now to this technique and often get a definite answer. For a while, after discovering the value of CO_2, I kept using O_2 for special cases; but the differences in the distress of the two groups of patients was so pronounced that I finally gave up the use of oxygen entirely. I think that others who compare the after effects of the two gases will come to the same conclusion, and that the use of CO_2 will win out, unless some one can find another gas which is absorbed in perhaps forty minutes. Even then, CO_2 might remain the gas of choice because it is cheap and a common article of commerce.

TRAUMATIC PNEUMOCRANIUM

By ALFRED S. DOYLE, M.D.

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PHILADELPHIA, PENNSYLVANIA

THE subject of traumatic pneumocranium is interesting inasmuch as only a few cases of this condition appear to have found their way into medical literature within the past decade. In THE AMERICAN JOURNAL OF ROENTGENOLOGY of December, 1913, Dr. W. H. Stewart of New York published what appears to be the first recognized case of abnormal intercranial air following fracture of the skull. It is interesting to note that while in the case reported by Dr. Stewart the air was on the right side and in the case which I am now reporting the air was on the left side, the condition was not suspected clinically in either case. In August, 1918, Dr. George W. Holmes of Boston published his case of air in the cranial cavity, and referred in his article to the cases reported by Dr. E. H. Skinner, Dr. W. H. Luckett, and one, not reported, by Walter Dodd.

In January, 1919, Dr. Hollis E. Potter of Chicago published a case in THE AMERICAN JOURNAL OF ROENTGENOLOGY and up to the present time that seems to be the only one on record in which the patient appears to have made a recovery either with or without surgical intervention. It is possible, however, that many cases of this condition presenting no clinical symptoms which would cause the patient to have an *x*-ray examination have passed unrecognized and made a complete recovery. The indication for operation would seem to depend entirely upon the symptoms, as is shown by the recovery of the case reported by Dr. Potter, in which the patient made a complete recovery without surgical interference, but at no time presented serious symptoms, and showed absorption taking place in subsequent exam-

FIG. 1. LATERAL VIEW OF THE LEFT SIDE OF HEAD, showing air in cranial cavity displacing anterior portion of left hemisphere. The lines of the depressed fracture in the left frontal and temporal region are also shown extending down to the base. Note that the fracture does not show well through the air cavity, because of the over exposure in this area.

FIG. 2. LATERAL VIEW OF RIGHT SIDE. There is no difference in size of the cavity, as it extends to the midline of the skull.

inations. In our case the patient presented symptoms which progressively grew worse until serious damage had been done to the frontal lobe of the brain and surgical intervention was evidently too late to save the patient. I have been unable to find any cases other than those referred to above with the exception of one reported by Dr. R. J. May of Cleveland and in THE AMERICAN JOURNAL OF ROENTGENOLOGY of April, 1919, in which case the plates were made several hours after death. The condition is somewhat unique in so far as it is not recognized or suspected until after the roentgen examination is made.

On June 7, 1919, the patient was struck by an automobile, at which time he received lacerations of the scalp in the supra-orbital region. He became unconscious and remained so for several days, and then regained consciousness, but complained of constant and severe headache in the left frontal region. He also complained of blindness in the left eye. The left eyeball was slightly sunken in the orbit. No operation was performed at the time beyond sewing up the wound. About the middle of August he became very irritable, but did not attempt violence either to himself or others. He also began to suffer from attacks of vertigo, and would faint three or four times a day.

About the latter part of August his mental condition became worse, and he developed auditory aphasia. When addressed he would frequently give a totally irrelevant reply. This condition became worse. His memory did not seem to be affected, for he had no difficulty in naming his nine children, stating their ages, dates of birth and death, and he seemed to be quite familiar with his circumstances and surroundings, and talked intelligently on topics of every-day interest. For some weeks previous to his admission to the wards of the University Hospital he would wet and soil his clothing, and claimed that he had no knowledge of having done so. He had evidently lost control over his bladder and rectal reflexes. His appetite was not affected and he slept well.

The patient was referred for roentgen examination September 2, 1919, and during the absence of Dr. Pancoast was examined by me. Stereoscopic plates were made of both sides of the head, also one postero-anterior of the frontal region, and one antero-posterior of the occipital region. The examination was made presumably to demonstrate a depressed fracture, which was found in the left frontal and temporal region. We were much surprised to find in addition a large air cavity. The plates of the left side (Fig. 1) showed the fracture involving the lower anterior section. The air cavity was oval in shape with irregular edges and measured 3½ by 2½ inches on the left side plate and about 2¼ inches in width on the plate made of the frontal region. (Fig. 3.)

Difficulty was encountered in obtaining the consent of relatives for the necessary operation; valuable time was lost, the patient gradually grew weaker, and the symptoms became more pronounced. Consent was finally obtained and operation performed September 24th. The skull was trephined in the left fronto-temporal region. The dura seemed tense and under pressure and upon opening it air rushed out with a hissing sound. It was found that the frontal lobe in this region was compressed by the confined air and the brain tissue was soft and lacked its normal resiliency. There was practically no bleeding and no evidence of previous hemorrhage. The dura was freed as far as possible from the skull to permit it to collapse and prevent the reforming of the air cavity. The condition of the patient rapidly grew worse and he died the next day.

The autopsy revealed two openings through the dura and a depressed fracture above the outer half of the orbit extending over to the temporal region in one direction and towards the cribriform plate of the ethmoid in the other. The brain tissue in the affected area was soft and did not expand after the air pressure had been released at operation. Brain tissue was adherent over the frontal sinus but no opening directly into

the frontal sinus was found. The dura was adherent to the skull in many places, and the air was under the dura. The fracture extended into the ethmoid sinuses, into which a probe was passed, and found a free passage into the nasal cavity on the left side. Considerable thick mucous was found in the passage through which the probe passed. This probably acted as a valve in admitting and confining the air.

The unusual features of this case were: (1) The length of time the patient lived with gradually increasing air cavity into which air constantly gained admission from the ethmoid cells and could not escape. (2) The condition was not suspected.

FIG. 3. POSTERO-ANTERIOR VIEW, PLATE ANTERIOR, showing the lateral dimensions of the air cavity.

FIG. 4. ANTERO-POSTERIOR VIEW, PLATE POSTERIOR, showing limitation to left hemisphere.

A RETINOMETER*

BY A. HOWARD PIRIE, M.D.

MONTREAL, CANADA

THE instrument which I present to you was made in order to allow me to test the sensitiveness of my own retina to the fluorescent screen. I use it for this purpose from time to time, but its chief field of usefulness is in its power to take up the attention of visiting physicians and surgeons who come to the fluoroscope with retinae rendered most insensitive by the light in which they are accustomed to work. These visitors to the fluoroscope are invariably willing to go on using the retinometer till they are ready to see the fluorescent screen to advantage. The more visitors who come at one time the better, as then there is competition between them as to who will first develop sufficient sensitiveness of his retina to be the first to use the instrument.

The retinometer consists of three luminous discs, the largest is a triangle, the medium sized one is oval and the smallest one is a circle with a diameter of about 1 mm. These three discs are kept in the dark by a covering flap which is kept in apposition

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with the discs by means of a spring. A string a yard long is attached to the flap. By pulling this string the discs are exposed. The free end of the string has a luminous tassel for the convenience of finding it in the dark. To use the instrument the observer picks up the tassel and pulls on the string; holding the tassel in his hand, keeping the string taut he places the tassel against his temple, his eyes are then at a distance of one yard from the instrument and the luminous discs are exposed to his view. He is now in a position to gauge the sensitiveness of his retinae. Most observers are able to see the luminous tassel at once. One who has come into the dark room from out of doors will be unable to see the large luminous triangle. But by going close up to it he will see it and he can then recede from it gradually, keeping it in view as his retina grows more sensitive. When he can just see the large triangle alone at the distance of the length of the string (one yard) he will be unable to see the next brightest spot—the oval, but by now going close up to it he will be able to see the oval and by the time he can see the oval at the distance of the length of the string, he is ready to begin to use the fluorescent screen. Until he can see the triangle and the oval in the dark his eyes are not in a fit state to look at the screen. It is folly to point out tuberculosis to a visiting physician when his eyes are not sensitive enough to see these two discs in the dark. Visitors to the dark room seldom stay long enough to be able to see the third luminous disc, but the radiologist should be able to see it plainly himself.

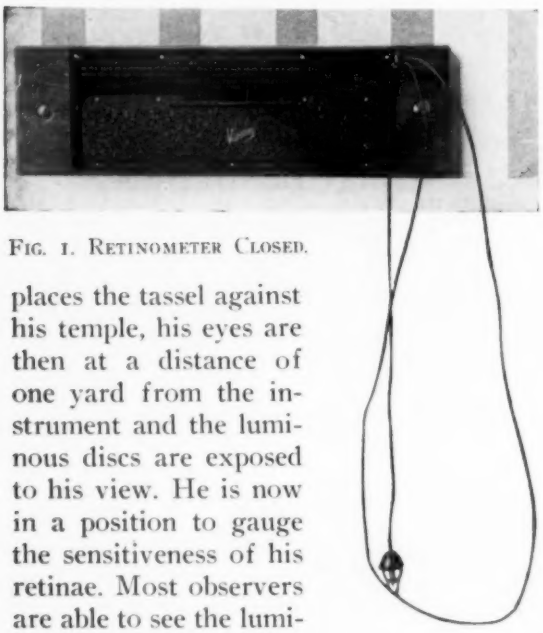

Fig. 1. Retinometer Closed.

When finished with the instrument the observer lets go of the string and it automatically closes, thus protecting the luminous discs from the action of light. The discs shine more brightly in the dark after being exposed to bright light and for this reason they are always kept in the dark and only exposed to view by the action of pulling the string. They remain of constant luminous power if they are not exposed to the light.

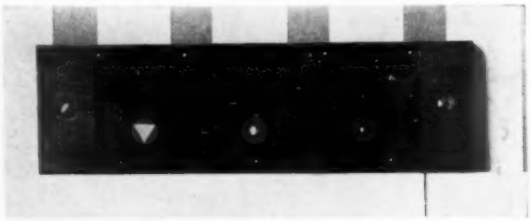

Fig. 2. Retinometer Open.

The three discs chosen for this instrument are the standard discs of a company manufacturing them. I picked them out of a large selection of standard luminous discs, and have been using them for more than six months during which I have noticed no change in the power of their luminosity.

Fig. 3. Retinometer in Operation.

I have to acknowledge the help of the Victor Electric Corporation in getting the instrument up in its present shape, which differs considerably from my first model.

INTRACRANIAL CALCIFICATION*

By JOHN T. MURPHY, M.D.

TOLEDO, OHIO

THIS paper is the result of an interest in the subject aroused by the following case:

CASE REPORT

Mrs. M. J. L. Referred by Dr. Pamment. Occupation: Bookkeeper. Age forty-seven. Married.

Previous History.—Negative except for diphtheria in childhood. Perineal repair in 1912. Menstruation began at eighteen years. Stopped at the age of forty-two. Always regular and no pain. Patient married at twenty-four years and had her first child at twenty-seven years, which died fourteen months later of infantile paralysis.

Convulsions began some time after an operation for repair of a perineal tear, in 1912. At first they occurred about twice a year, then four times a year and during November, 1919, she had four. With two exceptions they always came on during sleep. Her husband states that he would be awakened in the early morning by her moaning and would find her shivering, teeth set and some frothing at the mouth. She would be unconscious of the attack until the next morning, when she would find that she had passed her urine in the bed, and had a sore tongue and a severe headache. She would feel so tired and muscle sore that she would not go to work that day. She has had more or less headache, but noticed that the headache was very severe and continuous the whole month of November, 1919. Has had no nausea or vomiting. Has worn glasses for some time but has not noticed that her eyesight was getting worse previous to this last attack.

Present Complaint.

1. Paralysis of right arm and leg.
2. Inability to speak.
3. Drooling from right side of the mouth.
4. Convulsions.
5. Headache.

History of Present Complaint.—On Nov. 29, 1919, patient got up at the usual time, dressed herself and went to the kitchen to prepare breakfast, but was not conscious of it. Her husband saw that she was not well and insisted that she go back to bed. He tried to have her drink some coffee but she couldn't hold the cup. He put her to bed where she slept almost continuously for twenty-four hours.

Physical Examination.—Nov. 30, 1919. Patient is a robust woman, lying in bed, conscious but unable to talk. Head and Neck: Right side of face is smoothed out. Tongue protrudes to the right. Mouth is drawn to left. Drools out of right side of mouth. Right eyelid closes partly only. Patient tries to talk but cannot. Chest: Lungs—negative. Heart: Borders normal, rate, 70, rhythm good. No murmurs. Abdomen: Negative. Right Arm: Can move it part way to head. Left Arm: Normal. Right Leg: Can move it slightly. Left Leg: Normal. Blood Pressure: Systolic, 130; Diastolic, 85. Blood Wassermann: Negative. Spinal Fluid: Negative. Urine: Negative.

Since this time there has been a gradual return of normal functions. No convulsions since onset. As soon as the patient was able to be about she was brought in for examination with the *x*-rays. A stereoscopic set of plates showed the following:

A series of fine calcified lines, each forming part of a circle, was seen to lie above and behind the sella and about midway between the left side of the skull and the median line, the whole making a barrel shaped shadow with the long diameter transverse, size about ½ inch in width by about ⅝ inches long. There is also a distinct increase in the markings of the frontal bones on that side.

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On reviewing the literature an exhaustive study of the subject was found in the *Johns Hopkins Hospital Bulletin* for October, 1916, in which the entire subject of the use of the *x*-ray in brain tumor cases was taken up. The previously reported cases are reviewed. They are seven in number, all from the foreign literature. To these are added six of their own, found in a series of 100 cases clinically demonstrated brain tumors.

In THE AMERICAN JOURNAL OF ROENTGENOLOGY, 1916, III, is a report of a case by A. W. George, as follows: A man twenty-three years old. Stereoscopic plates of the head made in the lateral position show an

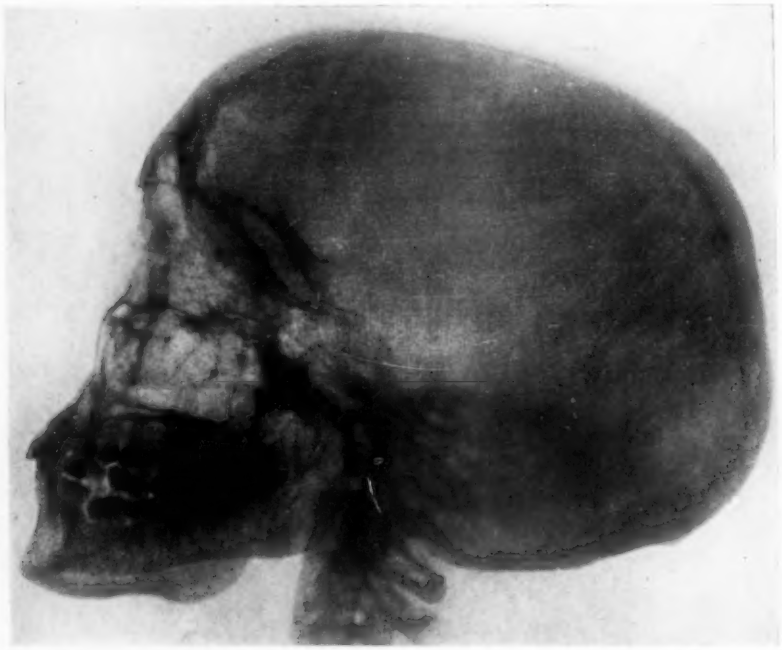

FIG. 1. SHOWING CALCAREOUS MASS IN LEFT SIDE OF SKULL.

In the cases reported in the foreign literature Fittig observed three calcified areas in the walls of a cyst in an occipital lobe; Grunmach a calcified tumor in the pineal gland; Algygi a basal tumor with areas of calcification; Klineberger a tumor of the occipito-parietal region; Steida a calcified cysticercus, and Sträter a calcified brain abscess only recognized after operation; Lichtheim a calcified gumma also not recognized until after operation. Schüller in his book reports five cases all of which are calcified areas in the brain substance itself. Huerig and Dandy's cases are as follows: One case of calcification of the brain substance, one case of calcification in the sella, one case of calcification extended from the base upward into the brain substance, one case of aneurysm of the internal carotid artery, and two cases of calcification above and very close to the sella.

area of about 3 cm. in diameter, posterior to the sella, with apparently calcified walls. The patient had been injured in the head while playing football and was unconscious. Epileptic attacks began about eighteen months ago. Operation showed a small tumor situated just below the pia mater and adherent to the midfrontal lobe, diagnosed as an encapsulated glioma.

In an endeavor to find out the general experience of roentgenologists, I wrote to twenty-five of the members of the Society, asking them to give me their experience with the demonstration of calcified areas within the skull. Many of the letters spoke of the calcification of the pineal gland, which was

considered as a normal finding. Except in four instances the replies were negative for other findings. Dr. Charles F. Bowen reported one positive case in approximately 200 cases examined. The history is as follows:

There was a calcareous deposit about 1 inch long and ½ inch wide which was found to be lying just above the external auditory canal about 1 inch from the inner table. It was lying in the brain tissue. This was removed at operation and his epilepsy cured. The man had had a fractured skull about fifteen years before. Dr. Bowen was of the opinion that a small piece of bone was driven into the brain tissue acting as a nucleus for the deposit of lime. The specimen however failed to show any nucleus of this kind. This was the only case in the experience of these men in which they were able to show calcification in the brain itself. One man had had considerable experience with calcified areas in the falx cerebri, the "psammoma" of the textbooks. Two other men called attention to the finding of calcified plaques in the meninges. Other than this the findings had all been negative.

The actual diagnosis of the case I have reported is in no way clear to me. Whether it is a cyst of the brain or an aneurysm of the anterior cerebral artery I am not sure. It is however clear from the clinical view-point that its presence has at times caused changes in the internal capsule; the absence of general signs of pressure is noticeable, and although the eyegrounds were not examined at the time of the paralysis, later examination shows them to be clear.

Roentgenograms made recently of the case seem to show that the tumor is less clearly defined; this however may be due only to difference of technique. The fact that the patient has been on small doses of the iodides continuously since, may have had some effect. She now is apparently in good health, with no headaches and only a small facial paralysis remaining.

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DISCUSSION

Dr. W. F. Manges. I know but little about the subject of the author's paper. I have seen quite a number of calcified masses in the skull. I have not come to the point where I want to take the time to study the literature on the subject, and unfortunately the cases are so seldom operated, that we really don't get to the final diagnosis in the matter.

I have recently had a case in which there was a calcareous mass that was fully an inch and a half in length and practically an inch in its greatest width, irregular in outline, and very much more densely calcareous than is shown in Dr. Murphy's case. This particular patient had no symptoms whatever, except headache. He was a clothing salesman, who had been working up to within two or three days of the time when I first examined him, but he did have at that time very violent headache. He stayed around the Hospital for a while, and became dissatisfied about something and went elsewhere. Finally someone started giving him iodides—his Wassermann had been negative both by blood and spinal fluid—but with iodides his headache disappeared, and he was apparently very much improved. I haven't had a recent radiograph of him, so I can not say whether or not there has been any change in the tumor.

In another instance, an adult, man, age forty-five to forty-eight years, had been perfectly healthy all his life, without any history

of injury until just shortly before my examination—I have, I believe, shown this case before this Society or some section of it previously—and the radiographs of the head showed a dense "stone," I called it, in his brain, within about a half inch of the cortex on one side. He came to me for examination because he had recently developed epileptic convulsions, never having had any during early life, and no family history of anything of the sort. What the origin of that density was, I haven't the faintest idea, but I think the injury he received shortly before he came to me was severe enough, and the weight of this thing sufficient, that the trauma that otherwise would not have been disastrous at all, set up an irritation which was the cause of his epilepsy. He refused operation.

Then again I have had a number of cases in which these calcareous nodules were multiple and scattered throughout the brain, near the cortex, and deep in the brain, and in only one instance did I have any idea as to what the cause might be, and that was the case of a child who gave a very definite history of tuberculous meningitis, and I thought perhaps there had been foci of infection in the brain at one time which had healed by calcareous deposit.

Dr. W. A. Evans. We have been able to classify intracranial calcifications under three general heads. The first is the calcification which occurs in cyst walls. These cysts have been observed both in infancy and adult life. Infants showing calcified cyst formation usually present evidence of impaired mental development or a spastic paraplegia. The calcifications occurring in adult skulls are usually associated with cysts which are secondary to a fracture of the skull or subdural hemorrhages. Plates of the head in a case recently referred for skull examination, with a history of epilepsy, revealed a calcification which occurred in the brain substance, the distribution of lime suggesting deep brain cyst.

Under the second heading are the deposits of so-called "brain sand." Of special interest at this time is the deposit of lime in the pineal body, it being claimed by some observers that the calcification of the pineal is evidence of its degeneration, with resulting loss of function; accordingly cases presenting abnormal sexual development should present atypical calcifications of the pineal gland. In our experience, there has been no constant connection between early deposits of lime in the pineal gland and precocious sexual development of thirteen, in which we were unable to show any brain sand in the vicinity of the pineal.

The deposits of brain sand in the falx cerebri, the so-called psammoma, should not be considered as the same type as a pineal calcification. Some pathologists classify them as a true bone tumor or osteoma.

Under the third heading, and this is probably the least important, is the calcium deposit in the walls of the blood vessels, especially the circle of Willis.

NEW ROENTGENOGRAPHIC TECHNIQUE FOR THE STUDY OF THE THYROID*

By GEORGE E. PFAHLER, M.D.

PHILADELPHIA, PENNSYLVANIA

MY experience in the study of the thyroid roentgenographically, heretofore, has been generally unsatisfactory. I have seen no description of technique that really demonstrates the outline of the thyroid except in very large thyroids or in the large substernal thyroids. These have been studied in the postero-anterior position, especially by Drs. Crotti and Bowen in their excellent paper presented before this Society in 1913.[1]

FIG. 1. P.24454-D. MR. J. S. CARCINOMA OF THE THYROID. Note the size of the thyroid, but particularly the irregular compression of the esophagus.

Since so large a number of the hyperthyroid cases are sent for roentgenotherapy, because of the excellent therapeutic results obtained in the treatment of toxic goiters, we have an excellent opportunity for a careful study of this group of patients. Therefore, in February of this year I determined to investigate these cases as thoroughly as possible roentgenographically, and have finally developed a technique that is almost universally satisfactory, because one can, by this method, demonstrate not only the abnormal thyroid and the enlarged thyroid, but the normal thyroid. I know of no other technique which will demonstrate the size and outline of the normal thyroid.

It is well known that the reduction in the thyroid by roentgenotherapy is one of the latest results obtained in the treatment of the exophthalmic goiters, or Grave's disease. I have many patients that have been cured, but unfortunately I do not have their original roentgenograms; that is, the roentgenograms made of their particular cases at the beginning of treatment. I am quite sure, however, that as this study is further developed and continued, we can record quite accurately the progressive reduction in the size of the goiter. Measurement of the circumference of the neck in determining the reduction of the goiter is very crude, for one may actually have a reduction in the size of the tumor, and yet an increase in the size of the neck, because it is quite well known that as exophthalmic goiter cases improve, they begin to take on weight. In fact, increase in weight is one of the earliest signs of improvement. As they increase in weight, naturally the circumference of the neck increases due to the deposit of fat, and therefore the goiter may be reduced while the circumference of the neck shows very little reduction or even shows an increase. It cannot, therefore, be depended upon as a method of recording the progressive reduction of a goiter.

1 CROTTI, ANDRE. The roentgen ray in intrathoracic goiter and thymus hyperplasia. *J. Am. M. Assn.*, Jan. 11, 1913, p. 117.

*Read at the Twenty-first Annual Meeting of THE AMERICAN ROENTGEN RAY SOCIETY, Minneapolis, Minn., Sept. 14–17, 1920.

In a number of cases patients are sent with symptoms of hyperthyroidism and one can feel little or no enlargement of the thyroid, but since I have been using this method of recording, I have not found one in which there was not an actual enlargement of the thyroid. I cannot say, however, that one does not have hyperthyroidism without an increase in the size of the thyroid. Occasionally a patient complains of difficulty in swallowing due to pressure in the region of the thyroid and yet, by palpation, the enlargement is so slight (or entirely absent), that it is difficult to understand how a patient can have such symptoms without palpable enlargement. By this method, however, compression of the trachea or pressure of the esophagus can be shown and these symptoms explained. It is well known that even the very large goiters may cause no pressure effects on either the trachea or the esophagus. On the other hand, a very small goiter or small adenoma may press posteriorly and cause a very distinct symptom of pressure and difficulty in swallowing or breathing without being palpable.

This method may be of value in differentiating malignant goiter from the benign goiter—probably only in occasional instances, however. In one case there was considerable irregularity in the outline of pressure upon the esophagus.

FIG. 2. P.29437-D. MODERATE-SIZED GOITER SHOWING MARKED COMPRESSION OF THE ESOPHAGUS.

FIG. 3. P.28929-D. NOTE THE COMPRESSION OF THE ESOPHAGUS BY A VERY SMALL GOITER IN A CASE IN WHICH THE GOITER WAS NOT PALPABLE. Note the enlarged lymphatic gland under the angle of the jaw.

TECHNIQUE

The examination is made with the patient in the standing posture. The position best showing the outline of the tumor is obtained fluoroscopically. The patient's sternum and the anterior portion of the neck is pressed strongly against the fluorescent screen. The chin is turned toward the side on which the enlargement is most marked and tilted upward as far as possible. This draws the thyroid up into position where it can be shown in the plate. One's aim must be to get a good lateral view of the neck, but both shoulders should be as nearly as possible in contact

with the plate. I think it is entirely possible that this same technique can be carried out with the patient lying down upon the table; but in my own laboratory I have found the above position more practical. The tube plate distance is 25 inches. The tube is centered midway between the lower border of the jaw and the upper border of the clavicle and centered directly over the thyroid. I use 8 by 10 duplitized films and double intensifying screens. The exposure will vary from three-fourths to one and a quarter seconds, depending upon the thickness of the patient's neck, with 35 milliamperes, and a 5 inch spark-gap.

With the above technique it is possible and advisable to examine every goiter patient that comes to the office, making a definite record at the beginning of treatment, and making further records during the treatment or at the end of treatment. Further use of this method of examination and detailed study will probably demonstrate more clearly its usefulness.

FIG. 4. P.28176-D. NORMAL THYROID. NOTE THE SMOOTH OUTLINE OF THE ESOPHAGUS, AND THE SIZE OF THE THYROID.

FIG. 5. P.28069-D. SHOWING NORMAL THYROID IN A PATIENT THAT HAD BEEN CURED OF EXOPHTHALMIC GOITER.

DISCUSSION

DR. L. JACHES. I would like to ask Dr. Pfahler to describe the position again. I did not quite get it.

DR. P. M. HICKEY. I was about to ask the same question. I did not quite get the angle. I thought perhaps he would again demonstrate the exact technique.

DR. B. C. DARLING. I would like to ask Dr. Pfahler if there is any possibility of confusing the sternocleidomastoid muscle in that position with the shadow of the thyroid.

DR. G. E. PFAHLER (closing). Answering Dr. Darling's question, if you study those plates carefully, you can see the sternocleidomastoid and why it would not be confused with the shadow of the thyroid. It was shown in a number of the normal cases. If you recognize the normal, it is easy to recognize the abnormal by comparison. I merely present this as a method and not as a final study. (Position again demonstrated by Dr. Pfahler, with Dr. Bowman as subject.)

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ANNUAL MEETING CENTRAL SECTION

The Second Annual Meeting of the Central Section of THE AMERICAN ROENTGEN RAY SOCIETY will be held on February 21, 1921, at St. Louis, Missouri.

Communications regarding the program should be addressed to the president, Dr. James G. Van Zwaluwenburg, Ann Arbor, Michigan. The chairman of the local committee, Dr. Edwin C. Ernst, 412 Humbolt Building, St. Louis, may be addressed concerning matters of arrangements.

ANNUAL MEETING WESTERN SECTION

The officers of the Western Section of THE AMERICAN ROENTGEN RAY SOCIETY are making plans for their second annual meeting. They have selected Portland, Oregon, as the place of meeting, and the time has been set for May 27th and 28th. This time will permit of a continuous trip for the western men who desire also to attend the A. M. A. meeting in Boston.

The Pacific Coast Roentgen Ray Society will meet at the same time and place, the two organizations being the guests of the Portland Roentgen Club, a very active organization of specialists.

The Secretary of the Western Section would welcome a visitor or two from the East with papers or demonstrations, and can assure them of a very enjoyable meeting. Address Dr. Warner Watkins, Box 1328, Phoenix, Arizona.

LAWRENCE HERSCHEL HARRIS

Lawrence Herschel Harris died at his home in Sydney on September 13, 1920,

LAWRENCE HERSCHELL HARRIS

after a distressing illness of fifteen weeks due to an encephalitis following influenza. He was the last of Australia's pioneer roentgenologists, having taken up this specialty in the late nineties. He was appointed roentgenologist to Sydney Hospital in 1900, and at the time of his death he was consultant to this hospital and also director of departments of Roentgenology at the Royal Prince Alfred and Royal Alexandra Hospital for Children in Sydney. He was made an Honorary Member of the AMERICAN ROENTGEN RAY SOCIETY in 1916 and was President of the Section of Roentgenology at the Australasian Medical Congress in 1913. He was visiting England in August, 1914, and volunteering immediately left London on August 16th with the Australian Voluntary Hospital for France. Later he was transferred to No. 3 A. G. H. at Lemnos, and after the evacuation of Gallipoli he was invalided to England on account of his dermatitis growing worse.

For many years he had suffered patiently with his hands. This did not affect his uncommonly genial and courteous manner which endeared him to the profession and patients alike.

He was the first man in Australia to do gastro-intestinal work, and as in everything else the standard he set was of the highest. He was always found to be most willing to give others the benefit of his experience. All roentgenologists in Australia owe a very great deal to one whose charming personality and high professional attainment will live long with all, while to the large circle of those more privileged to have known him as a friend, the memory of that kind, generous and true white man will be theirs always.

L. J. CLENDINNEN.

TWENTY-FIFTH ANNIVERSARY OF THE DISCOVERY OF THE X-RAY

The New York Roentgen Society celebrated the twenty-fifth anniversary of the discovery of the *x*-ray on December 11, 1920.

The celebration was held at the New York Athletic Club, New York City, and took the form of a dinner with members of the Philadelphia and New England Roentgen Societies as guests. Fifty-two members and guests were present, with Dr. H. M. Imboden, President of the New York Society, acting as Toastmaster.

Following the dinner Dr. Percy Brown of Boston proposed a silent toast to those former members of the Societies who had lost their lives as martyrs to the advance of roentgenological science.

Prof. J. S. Shearer, speaking on "*X*-Ray and Research," drew attention to the large part that branch has played in the discovery of electrical science and especially of that branch with which roentgenologists are concerned.

Dr. F. H. Baetjer in discussing "*X*-Ray Diagnosis, Its History and Present Status," recounted delightful reminiscences of the early days of the work at Johns Hopkins University in the late 90's and early part of the present century.

Dr. C. W. Holmes followed with some remarks on the present status of *x*-ray therapeutics, and the evening was closed by Dr. W. D. Witherbee, who presented a "Preliminary Report on the Effect of *X*-Ray upon Tonsillar Tissue."

CHARLES EASTMOND.

REPORT OF COMMITTEE ON TEACHING

In recommending a course in roentgenology for undergraduate medical students your committee finds that it is not an easy task to determine just what is the proper amount of instruction to meet the actual needs of the medical or surgical practitioner without loading him with a mass of interesting but technical information that he cannot use.

In determining an ideal course, the question that first arises is whether it is advisable to crowd into a curriculum already more than full, another separate course, when it is so intimately bound up in nearly every other subject of the curriculum that hardly can any branch be properly taught without dealing with its roentgenologic aspects. Does a student then acquire in the other courses

a sufficient knowledge of the subject to be able to read and intelligently digest the roentgenologic reports and illustrations in an article or lecture that has a roentgenologic aspect? Your committee finds that there are two extremes with perhaps as cogent reasons for one view as for the other. One of these holds that roentgenology is a specialty for those trained therein and that the medical or surgical specialist be given only the results of his investigations. This same argument would apply with equal force to the pathologist and clinical diagnostician. Who would have the temerity to advocate leaving these two subjects to the mercy of the teachers of other branches?

The other extreme tends to attempt to make roentgenologists of all medical graduates and thus bury completely the subject as a true speciality. There seems to be a middle ground that can safely be adopted, one that will acquaint the student with the scope and usefulness of the agent, enable him to know when to call in the services of the roentgenologist, how to prepare patients for the exination, to understand the reports that are submitted, and to know how and why the conclusions have been reached—all this without any practical knowledge of handling the apparatus or any of the technique employed.

Your committee therefore submits the following as a fair minimum of instruction to accomplish the ends that appear to be desired:

(a) That the subject be taught preferably in the junior and senior years.

(b) That a minimum of forty-two hours be given each student.

(c) That the junior course consist of at least three lectures and demonstrations as a general introduction, and at least twenty-nine lectures and demonstrations dealing with the diagnostic field and therapeutic applications as well as the dangers and methods of preventing injuries.

(d) That the senior course be a minimum of eight hours per student consisting of demonstrations of clinical cases to the sections.

It is especially desirable that the senior students follow their cases to the roentgen ray laboratory, see the examinations made and the findings interpreted and reported.

The committee further recommends that the use of roentgenologic methods be employed to the fullest extent practicable in the teaching of anatomy, physiology and the other fundamental subjects, and that there should be the closest possible cooperation between these departments and the roentgenologist.

A. L. Gray, *Chairman.*
F. S. Bissell
P. M. Hickey
J. S. Shearer
W. F. Manges
Committee on Teaching.

REPORT OF SECOND ANNUAL MEETING EASTERN SECTION

The second annual midwinter meeting of the Eastern Section of The American Roentgen Ray Society was held in Atlantic City January 28th and 29th, in the new Chalfonte-Haddon Hall auditorium, with the president, Dr. David R. Bowen, of Philadelphia, presiding.

In point of attendance this was the largest midwinter meeting ever held, and from the enthusiasm expressed by those in attendance, must be rated as one of the most successful.

The Friday evening session was devoted to diversified subjects on *x*-ray diagnosis. The Saturday morning session was devoted entirely to subjects involving *x*-ray physics. The Saturday afternoon session was given over to a symposium on *x*-ray therapy and a symposium on lung diseases. The Saturday evening session, as is customary, was devoted to the lantern slide exhibit. This exhibit has come to be recognized as the place where most roentgenologists bring their difficult and unusual cases.

The discussion at the morning and afternoon sessions on Saturday developed the feeling that there was need for coordinated physical and pathological research in the

therapy field. Special emphasis was laid upon the necessity for pathological research, the feeling existing that physical research was advancing beyond the pathological. By resolution the President was authorized to appoint a committee to make recommendations to the parent society at its annual meeting as to how this coordinated research could best be done.

The commercial exhibit was an innovation at midwinter meetings. There was a large number of exhibitors and a great deal of interest centered in the new apparatus exhibited.

At the election of officers, held on Saturday evening, Dr. J. M. Steiner of New York was elected president for the ensuing year and Dr. C. A. Waters of Baltimore, was elected secretary. J. M. STEINER, *Sec.*

A CORRECTION

In the January number of the present volume, page 24, there is an article entitled, "Dislocation of the Carpal Scaphoid." The word "scaphoid" is used throughout the article and in the legend. "Scaphoid" is an error, as the condition is evidently a dislocation of the semilunar bone.

BOOK REVIEWS

A. DAUVILLIER, *Recherches Spectrométrique, sur les Rayons X.* (Thesis presented to the University of Paris.)

This thesis describes the author's experiments on the variation in *x*-ray spectra when various tubes and methods of excitation are employed. It is indeed fortunate that this admirable piece of research has appeared at this time, when such extravagant claims are made for certain types of apparatus. It is clear that we can never have a rational basis for *x*-ray therapy until we know the true distribution of the radiation from the tubes. Without definite knowledge of this kind we are quite unable to decide between various operating devices or to coordinate our work.

Omitting, in a brief review, the technical details of the experiments, the points considered and the conclusions are briefly as follows:

1. What variations in spectral emission of *x*-rays are to be expected with different tubes when operated on various available wave forms?

2. To what degree is the output of short wave lengths influenced by the type of tube and mode of operation?

3. Are the limiting wave lengths observed for different voltages in accord with the predictions of theory?

4. What are the practical indications for therapy?

As regards No. 3 above, the author finds agreement with the theory and determines the displacement of the wave length of maximum ionizing power toward the short wave length portion of the spectrum. He points out that the claims of superpenetration and unusual homogeneity claimed for the Lilienfeld tube are entirely unwarranted from the data at hand, disposing very effectively of the claim that spectral distribution varies with cathode ray concentration.

The practical indications are in entire accord with the views often expressed by those familiar with fundamental physics and who are not misled by experimentation intended to support some preconceived notion or widely advocated method of measurement. The author's statement is as follows:

"The results mentioned permit standardization of *x*-rays, thanks to the Coolidge tube. We propose to replace the present procedures in dosage, empirical and naturally lacking in precision, by some simple direct measurements of tension, intensity of tube current, distance and the duration of exposure. The fundamentals standardized will be:

"1. The type of tube: Tubes of pure electron emission.

"2. The target material: Tungsten.

"3. The wave form of the electromotive force: Sinusoidal or preferably constant. The independent variables will be:

"4. The maximum tension (measured by a voltmeter).

"5. The mean intensity of current.

"6. The nature and thickness of the filter used.

"7. The distance from focus to skin.

"8. The duration of exposure.

These conditions completely characterize the radiation and permit its exact reproduction independent of all spectroscopic measurements."

The author promises further investigation to determine for all workable conditions the actual spectrum distribution.

With such information as to the delivery of radiation from the tube and the recent exact study of absorption coefficients by Richtmyer and Grant we shall be able to eliminate the vagaries and uncertainties that now beset *x*-ray therapy.

The work of this author and those who supported and encouraged it is not only extremely valuable, but is a splendid example of the true spirit of research. It was carried on as an extra load during the turmoil and strain of the war when so few were even thinking of these unsolved problems.

J. S. SHEARER.

Subscribers to THE AMERICAN JOURNAL OF ROENTGENOLOGY *visiting New York City, are invited to make the office of* THE JOURNAL (*69 East 59th Street, New York*) *their headquarters. Mail, packages or baggage may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; in this case, kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

TRANSLATIONS & ABSTRACTS

ROBERTS, PERCY WILLARD, New York City. Syphilitic and Tuberculous Joints. (*Am. J. Syphilis*, April, 1920, iv, No. 2, 302.)

During the past four years he has observed over two hundred bone and joint cases which were undoubtedly of luetic origin and which possessed the symptoms usually ascribed to tuberculosis. It is interesting to note that fifty-one of these cases were diagnosed as tuberculosis by twenty-six experienced surgeons and treated on that basis for periods varying from a few months to fifteen years. In some of them there was a positive Wassermann of from one to four plus, and in all of them there was subsidence of active symptoms a few weeks after the exhibition of mercury and potassium iodide. The Treponema pallidum may produce tubercles identical in structure with those in which the tubercle bacillus is found. In both lues and tuberculosis an affected joint will present symptoms of irritation and there will be muscular spasm. In both diseases there may be enlargement of the joint with effusion and the formation of pus, sterile on ordinary culture media. There may be sensitiveness, limp when a weight-bearing joint is involved and alteration of attitude if the disease is vertebral. *X*-rays may show a bone lesion in either disease, but contrary to accepted theories there are usually no definite characteristics upon which to base a diagnosis. "In a series of fifty of the cases the Wassermann reaction was so frequently negative in the face of other evidence of spyhilis and satisfactory therapeutic results that it may be said that in the late manifestations of inherited lues it is only occasionally of value. The duration of the disease bore no relationship to the possibility of treatment. Two knee cases, one of six and the other of ten years' duration, recovered practically normal function, with regeneration of the necrotic bone area. A spine case of fifteen years' duration gained sixteen pounds in ten weeks. Three out of seven profusely discharging sinuses in this case closed completely and the secretion from the others became thin, watery, and of small volume. When the patient passed from observation, he was able to take long walks and was leading a normal life. A hip case of twenty-five years' standing in which almost constant pain had been a predominant symptom, became entirely comfortable in about ten days. His Wassermann was positive. All of these cases had been under continuous treatment for tuberculosis from the onset of their symptoms."

ROHDENBURG, G. L., AND PRIME, FREDERICK. The Effect of Combined Radiation and Heat on Neoplasms. (*Archives of Surgery*, January, 1921, II, No. 1, 128.)

Low degree of heat applied for varying periods of time have a lethal action on neoplastic cells in vitro, and this lethal action with proper dosage is effective in 100 per cent of cases. Histologic examination of tumors which have been treated by diathermy reveals cellular changes similar to those observed in tumors exposed to radiation.

Wood and Prime have shown that any tumor may be killed by a sufficient dosage of either radium or roentgen ray; but that in maiy instances the patient will not survive the dosage necessary to bring about the death of all the cells of an internal, highly malignant carcinoma or sarcoma. Our experiments demonstrate that by combining radiation with an agent not so destructive to the organism the field of usefulness of radiotherapeutic measures may be extended.

While the principles worked out in the animal experiments here recorded are already being applied in the treatment of cases of neoplasia in human beings, the technical development of the method and the evaluation of the final results will require long and careful observation of the patients before its applicability can be demonstrated.

CHASE, SUMNER B. The Roentgen Ray in the Diagnosis of Sinus Disease. (*J. Iowa State Med. Soc.*, December 15, 1920, x, No. 12, 404.)

Two positions are commonly used, the postero-anterior and the lateral, the latter of which is sometimes stereoscoped. The Caldwell position is commonly used for the frontals. One of

the earliest signs of malignancy in the antrum is an even clouding in the plate with a slight break in the outline of the wall. The plate should be carefully examined for signs of teeth such as are found in dentigerous cysts, and if present the alveolar process should be examined for the loss of one or more teeth. These cysts cause bone absorption and not bone destruction. Osteomata present a characteristic appearance of a solid growth, while odontomata show well defined walls enclosing one or more teeth. A giant cell sarcoma presents the usual trabeculated appearance. A malignant growth is differentiated in the plate from the clouding of an empyema or a thickened mucosa by the fact that the bone itself is attacked. The vertical position for the sphenoid examination he regards as important, as by it can be determined the presence or absence of a large posterior ethmoidal cell or a perisphenoidal cell which sometimes lies adjacent to the sphenoid and may simulate disease in this sinus. For instance, the lateral plate will show a cloudy appearance of the sphenoid while the vertical plate will prove this to be a large opaque ethmoid lying adjacent to the sphenoid with the latter clear. It also helps to determine on which side to operate for pituitary tumor by the nasal route because these sinuses are not symmetrical.

A differential diagnosis between polyps and mucocele can not be made definitely although the polyp is more liable to have associated inflammation of the mucous lining of the antrum which would produce a certain amount of clouding of the remaining portion.

He quotes experiments which Caldwell made showing that the shadow cast by various fluids, such as water and pus, was practically the same and that mucous membrane soaked in water casts a much denser shadow than dried mucous membrane.

The roentgen ray is a valuable aid in the diagnosis of accessory nasal sinus conditions. Anatomical details of practical surgical and therapeutic importance are shown.

The history, symptoms and clinical findings should be taken into consideration in interpreting the plate.

With properly taken plates, and ruling out previous operative interference, blurring of the margin, or entire extent, of the larger sinuses is interpreted as a pathological condition in the sinuses.

The obliterations of the septa in the small sinuses as the ethmoids, with correctly taken plates and no previous operative interference, indicates pathology present.

The roentgenogram of the sphenoidal sinus as to the condition of the lining of the sinuses is still unsatisfactory.

In certain conditions the diagnosis of the pathology present may be made by the *x*-ray alone.

Pathology is very rarely found in sinuses that appear absolutely normal in the roentgenogram, although it is possible in early acute cases to have pus present with practically no shadow shown in the plate; and all clinical means of examination should be used.

STEINDLER, ARTHUR. Congenital Malformations and Deformities of the Hand. (*J. Orthopedic Surg.*, November, 1920, ii, No. 12, 639.)

This very interesting paper is enhanced by the following classifications:

A. Deformities by developmental suppression, agenesis:
   1. Congenital Defect of the Forearm Bones.
   2. Lobster Claw Hand.
   3. Ectro-dactyly (A-phalangism).
   4. Hemimelia.

B. By Developmental Arrest.
   1. Syndactyly.
   2. Sym-phalangism.

C. By Developmental Aberrations.
   1. Polydactyly (some cases).
   2. Hyper-phalangism.

D. Dysplastic Conditions.
   1. Chondro-dystrophy.
   2. Brachy-dactyly (some cases).
   3. Fusion of carpal bones.

E. Polyglandular Dystrophy.
   1. Polydactyly (some cases).
   2. Macro-dactyly.
   3. Arachno-dactyly (partial gigantism).

F. Contractures (Neurogenetic or amniotic).
   1. Contracted Club Hand.
   2. Contracted Fingers.
   3. Amniotic contractures (non symmetrical).

The author confines himself closely to the discussions of his classifications in the twenty-five case reports which are summarized in the following:

1. Of the 25 cases reported, hereditary tendencies were in evidence in 5 cases, deformities of the hand being found in other members of the family in 3 cases, other deformities or anomalies in 2 instances. Identical deformities in family twice, one case of syndactyly and one case of congenital club hand.

2. Complicating deformities of the extremities were found in 15 cases, among which complicating deformities of the hand 4, namely: Symphalangism in one case of syndactyly; Syndactyly in one case of congenital ulner club hand; Syndactyly in one case of contracted club hand, and syndactyly in one case of lobster claw hand.

3. Complicating deformities of the spine and thorax were found in 3 cases.

Rhachitic deformities of spine and thorax in one case of syndactyly.

Congenital scoliosis with wedge shaped vertebrae in one case of contracted club hand.

Elevation of scapula, wedge formation of vertebrae and fusion of ribs in one case of congenital contractures of the fingers.

4. Complicating signs of degeneration and general developmental aberrations were found in 5 cases.

Acrocephaly in one case of syndactyly.

Malformation of genitals, high palate in 2 cases of contracted club hands.

Cleft palate in one case of aphalangism.

Three cases of this group showed deformities and contractures in all extremities.

5. Birth complications were found in 4 cases.

Instrumental delivery in 3 cases (1 syndactyly, 2 congenital club hands).

Twin birth and cord constriction in one case (contracted club hands and general contracture).

6. Primary developmental errors were assumed to be the causative agent in the majority of cases, in one case only amniotic constrictions could be held responsible; polyglandular (endocrine) dysfunction was suggested in 3 cases by malformation of the bones of the head and genital hypoplasia.

ORMEROD, F. C. On the Treatment of Oriental Sore by *X*-Rays. (*Lancet*, October 30, 1920, p. 893.)

During 1918-19 the author treated a large number of oriental sores by applying *x*-rays and observed satisfactory progress in most and cure in a large percentage of cases.

The advantages of the *x*-ray therapy may be enumerated as follows: 1. The rays act directly on the causative organism. 2. They are able to penetrate unbroken skin or masses of diseased tissue, thereby being efficient in ulcerated and non-ulcerated sores alike. 3. Cases can be treated as out-patients and can very often continue their occupation. 4. There is no risk of constitutional disturbance, the danger of dermatitis or necrosis being absent with the doses utilized. 5. The treatment is short, painless and easy to administer. 6. Doses in awkward positions, such as the inner canthus of the eye, lips and alae nasi can be very readily dealt with. 7. The scars left after healing are supple and of such color after about six months as to be barely noticeable.

In conclusion, the author suggests that *x*-ray therapy may be of value in the treatment of the allied forms of leishmaniasis—espundia and kala-azar—as *x*-rays have an undoubted effect on the Leishman-Donovan body.

HARET AND TRUCHOT. Radiotherapy of Sciatica. New Technique. (*La radiotherapie de la sciatique. Essai de technique nouvelle. Bulletins et Mémoires de la Société de Radiologie médicale de France*, October, 1920, No. 72, p. 122.)

These authors briefly review the work of previous radiotherapists and describe the following as the technique they have used with the best results in eighteen cases. In six cases of sciatic neuralgia (pain symptoms only, without atrophy or change of sensibility and with normal reflexes) they got six cures with two and three series of five sittings each. In twelve cases of sciatic neuritis (continuous pain, muscular atrophy, trophic trouble, troubles of sensibility, abolition or diminution of the tendo achilles reflex) they got seven cures with three and four series of five sittings each; three cases much improved, with the same amount of treatment, and two cases only slightly improved, frankly considered as failures.

The authors refer to the differences of opinion of the massive dose and divided dose enthusiasts. They recommend the use of the Coolidge tube, four milliamperes of current, with twenty-five centimeter (ten inch) spark-gap;

anticathode-skin distance twenty-two centimeters (9 inches). The treatment was administered over the foramina of the fourth and fifth lumbar vertebrae and the first, second, third and fourth sacral vertebrae of the affected side. In one class of patients, they gave doses of three H. units measured under three millimeters of aluminum filter at eight day intervals. A second group of patients received 1 H. unit measured under three millimeters of aluminum every other day with an interval of one week's rest after five or six sittings. To a third group during five consecutive days they administered a daily dose of 1 H. unit measured under four or five millimeters of aluminum filter; then five days of rest. A new series of five sittings was then given with a daily dose of 1 H. unit followed again by five days of rest and so on. The authors have finally settled on this last technique as giving them the greatest degree of success. The different cases varied in their response to treatment, but generally one sees a definite improvement by the end of the second or third sitting. In a few fortunate cases, they have obtained cure with two series of five sittings each; they have never exceeded four series on anybody.

JAMES T. CASE.

DUNCAN, REX. Epithelioma of the Lip, with Observations and Results in the Treatment of Eighty Consecutive Cases with Radium. (*Urol. and Cutan. Rev.*, xxiv, No. 10, 586, October, 1920.)

From a study of eighty consecutive cases, the author reaches the following conclusions: Epithelioma of the lip may occur at any age, near or after the third decade and in the absence of any definite etiological factor. Any wart-like, ulcerated or indurated lesion of the lip which persists more than two months under ordinary treatment, must be considered suspicious of malignancy. In questionable cases a section for diagnosis followed by immediate treatment is advisable. In the majority of cases, the macroscopic appearance is typical and a diagnosis can be made by a competent observer. Epithelioma of the lip is always a serious condition and should receive prompt treatment.

Radium therapy yields a higher percentage of cures than any other method of treatment. There results less inconvenience, loss of function and disfigurement than from surgery or other treatment. Palpable lymphatic glands should be immediately treated with radium. If unimproved after four weeks, they should be resected and radium buried within the wound. A uniform application over the lesion, and in certain cases the burying of the proper dosage within the tumor, are essential. This is obtainable only by the use of radium emanation.

TAFT, A. ROBERT. The Comparative Value of Radium and *X*-Rays in the Treatment of Keloid, Nevi, Angioma, Leukoplakia and Other Lesions of the Skin and Mucous Membrane. (*Urol. & Cutan. Rev.*, Vol. xxiv, No. 10, p. 590, October, 1920.)

The author's results with keloid have convinced him that while the *x*-ray is a splendid remedy and the only one until the introduction of radium, yet the radium is even better.

In leukoplakia the hardest rays possible are advocated by everyone, and this in conjunction with the ease of application makes radium the ideal remedy.

In acne vulgaris the large area to be covered makes *x*-ray the choice, but in acne rosacea the author believes that radium is more efficient.

In lupus vulgaris, lupus erythematosus, ring worm, sycosis, etc., he has used the *x*-rays with such satisfactory results that he has hesitated to make a change.

It has been noted that in some skin diseases covering large areas, psoriasis for example, limited treatment with *x*-ray and clearing up a few lesions will result in a marked improvement of all other lesions. This is said to be due to some general effect. The author has treated in this manner lichen planus, various types of eczema, etc., and has seen many of these clear up generally as a result of a few local treatments. He believes the results to be due to absorption of killed diseased cells with formation of vaccines. It is so much easier to produce a local reaction in definite small areas that radium is better for this purpose than *x*-rays. Three cases of chronic genital sores were treated successfully within the last year by radium.

Angiomata, especially of the lips, responds well to radium, which is certainly the remedy

of choice although in larger growths fulguration followed by radiation is quicker and easier.

Nevi are better treated by radium than by any other method. Although warts respond well to radium, a less tedious and less expensive treatment is to be advocated in all but selected cases.

WILKINS, W. A. The Diagnostic Value of the *X*-Ray Examination in Pulmonary Tuberculosis (*Canadian Med. Assn J.*, Vol. x, No. 11, p. 99, November, 1920.)

Since the earliest days of roentgenology the aid of the *x*-ray examination has been invoked for diagnostic assistance in cases of suspected pulmonary tuberculosis and to-day its employment is a very important part of the routine examination of the chest. Nevertheless, there is considerable confusion concerning the interpretation of the shadows seen on the plate. The *x*-ray appearances of pulmonary tuberculosis vary with the stage of the disease. The shadow cast by the pathological tissues may be of any degree of density, including the faint filmy shadow of the very early case, the mottling of the more advanced disease and the dense shadow of the healed lesion. At times, the first indications of disease will be detected by the physical examination; at other times the *x*-ray alone will show the early changes and the *x*-ray affords the most accurate information that can be obtained apart from the autopsy, at least for the extent of the disease. Usually when physical signs are present, the *x*-ray will demonstrate the area of involvement to be more extensive than was indicated by the physical examination. No method or combination of methods at present employed will detect invariably the earliest signs of disease in every case nor decide positively at all times the activity of a lesion. The *x*-ray will demonstrate the site and the extent of the tissue changes, and although usually it is possible to infer from the *x*-ray plate alone whether the lesion is active or not, this decision should be left to the clinician to make. To discover on the *x*-ray plate indications of pathological changes in the tissues, usually requires the support of clinical evidence of disease, before concluding that the changes can be due only to tuberculosis. Otherwise the discovery may consist of nothing more than the recognition of a condition which has long since ceased to be a matter of medical interest. The clinical support need not be confined to the presence of physical signs within the chest, but may be manifested by the presence of general symptoms of ill health. Definite indications of pathological changes in the lungs so often are seen on the *x*-ray plate, not only in individuals who apparently are in perfect health, but also in those who give no history of having suffered from a serious illness at any time, that one is forced to the conclusion that tuberculosis of the lungs is frequently a mild disease, often running its course from onset to recovery unrecognized.

DAVIS, J. S. The Radical Treatment of *X*-Ray Burns. (*Ann. Surg.*, Vol. lxxii, No. 2, p. 224, August, 1920.)

X-Ray burns are usually caused by the use of *x*-rays in the treatment of skin lesions, such as psoriasis, eczema, superficial epithelioma; by frequent exposures extending over a long period of time in the treatment of inoperable or incompletely removed carcinoma; by the reckless use of the apparatus in the hands of unskilled operators and by long fluoroscopic exposures.

The author has had under his care burns situated in almost every region of the body. Some of them have been of the first degree, where the skin is reddened; a few of the second degree, where blisters formed; the vast majority have been of the third degree, where the full thickness of the skin and often the underlying tissues were involved.

Recent *x*-ray burns of all degrees should be treated as ordinary burns but unless there is a fairly prompt response to such treatment it is a mistake to continue it.

Palliative measures should be used in burns of the first degree. Paraffin films are often comforting; painting with collodion, or the application of sterolin (Formula: Balsam of Peru, 4 c.c.; castor oil and Venetian turpentine, of each, 2 c.c.; alcohol, 95 per cent, 100 c.c.), or some bland ointment, are useful.

In burns of the second degree, it is often difficult to tell at first the depth of such a burn, as one which seems to be merely blistered will turn out to be much deeper in places after the blisters have been removed. Wet dressings

have been found more comfortable in these cases than paraffin or ointments.

In burns of the third degree which do not heal promptly and permanently by the usual methods more radical methods must be adopted. The ulcer and surrounding area of induration should be excised with a wide margin out to and down to healthy tissue. After excision the defect should be grafted immediately if the base of the wound is of normal tissue, but if doubtful tissue is left, grafting should be deferred until granulations form. The type of graft used should depend upon the situation. The author uses "small deep grafts" in the majority of instances, but has used with satisfaction Ollier-Thiersch, or whole-thickness grafts in selected positions.

Pedunculated flaps from neighboring tissues, or from a distant part, have been of great use in situations where a pad of fat, in addition to whole-thickness, was necessary.

The best method of relieving the pain, aside from the excision of the affected area, is to divide the nerves supplying the area.

X-Ray or radium used in the treatment of *x*-ray burns has not been followed by any benefit. Patches of keratosis on the *x*-ray operator's hand, following frequent exposures without protection, may be successfully treated by freezing with carbon dioxide ice. Should the patches ulcerate, complete excision with immediate or subsequent grafting is the method of choice.

In instances in which tendons have been destroyed it is advisable to fill the defect with a pedunculated flap of skin and fat, and later to restore the tendon by the method best suited to the particular case.

Where large areas are involved we seldom excise sufficient tissue and infection sometimes occurs in the margins of these wounds. There may be sloughing of the entire margin of the wound, although the excision has been apparently complete. For this reason it is wise to defer grafting, or the transference of a flap.

In fulminating infections occurring in areas of the skin which have been burned by *x*-rays, prompt excision with a generous margin is indicated. Amputation of the part may be necessary to control the rapid spread of the infection.

The author's after-results of excision with grafting, or flap-shifting, have been most gratifying. Function has been restored in many instances and patients who have been incapacitated for years have been returned to their former activities.

DENIS, W., AND MARTIN, CHARLES L. A Study of the Relative Toxic Effects Produced by Regional Radiation. (*Am. J. M. Assn.*, Vol. clx, No. 4, p. 555, October, 1920.)

Constant extension of the field of roentgen ray therapy has brought into increasing prominence the condition of "treatment sickness," the constitutional reaction which frequently follows the use of massive doses of the hard roentgen rays. The underlying cause of this reaction is unknown. It has been ascribed to various and diverse factors. A factor which has been considered but little is one involving the question of the relative severity of symptoms following radiation of different parts of the body. The authors have collected the results of experiments with rabbits undertaken to determine whether by the radiation of certain portions of the body roentgen ray intoxication is more easily produced and in more severe form than by radiation of certain other portions.

It was found that a definite dose of roentgen rays administered to the body of a rabbit produces a severe systemic reaction and death only when some portion of the intestinal tract lies within the irradiated area. Furthermore, it is possible to produce a definite acidosis (lowering of the alkaline reserve) in rabbits by administering a heavy dose of roentgen rays over the abdomen. Such animals give no evidence of suffering from a "roentgen ray nephritis."

The results suggest the hypothesis that acidosis may be a factor in "treatment sickness" following abdominal irradiation.

GUNNING, R. E. LEE. *X*-Ray Manifestations of Diseases of the Chest. (*Illinois M. J.*, Vol. xxxviii, No. 3, p. 196, September, 1920.)

The early diagnosis of pulmonary tuberculosis presents one of the most difficult clinical problems. The *x*-ray is merely an added form of examination but more exact. This form of examination should never be neglected any more than the stethoscope. It must be remembered, however, that a negative *x*-ray examination does not mean a normal lung. Positive evidence alone is of absolute value.

In all forms of chronic or sub-acute pulmonary tuberculosis with the clinical diagnosis evident, radiology is used simply to (1) confirm diagnosis; (2) differentiate pseudo-tuberculosis; (3) study development; (4) disclose complications; (5) furnish therapeutic indications.

The radioscopic appearance in these cases shows the widest variations as does the pathology. All manifestations from questionable shadows to absolute opacity or involvement of entire hemi-thorax or both pulmonary fields are seen. The most unexpected forms and localizations may be established. The stethoscopic signs may indicate severe involvement and the *x*-ray negate this and vice versa.

Abnormal shadows are seen most often to affect the apices and hilus in general. The shadows are scattered, varying in density and separated from one another by clearer spaces. Tuberculosis develops through foci. In confirmed tuberculosis, abnormal shadows are found on both sides but usually predominating on the side first affected. In advanced cases the shadows reach the lower lobes and the apices become spotted with clear zones due to cavitation.

SOILAND, A. Cancer of the Lip. (*Urol. & Cutan. Rev.*, xxiv, No. 10, 599, October, 1920.)

Every lip case should first of all be given *x*-ray treatment to the entire neck and soft tissues of the lip and jaws, and this should be done most thoroughly. This procedure is now followed in the writer's service, whether or not glands are palpable. The lip lesion itself is then attacked, the method used depending upon the location and extent of the growth. When the lesion is rather superficial and involves not more than one-third of lip along both marginal borders, radium alone is sufficient. If it is a little more extensive and reflected downward over the skin surface, combined radium and *x*-ray give excellent results. If the lesion is more extensive and of cauliflower appearance, electrical desiccation by means of the Oudin bipolar method has given splendid results. After the slough has passed, careful radiation should follow.

Straight surgery of the lip is indicated only where extensive resection is contemplated, and should in all cases be supplemented by radiation.

WEINBERG, JOSEPH A. The Influence of the Exposure of the Roentgen Ray on the Progress of Tuberculosis. (*Arch. Int. Med.*, Vol. 25, p. 565, May, 1920.)

It is generally agreed that the best method for diagnosing tuberculosis of the genito-urinary tract is by the inoculation of the urine of suspected cases into the peritoneal cavity of a guinea-pig. However, this test loses much of its practical value because of the time which must elapse before lesions are apparent in the animal after inoculation. This work was undertaken with two purposes in view: First, to shorten the time of development of tuberculosis; Second, to determine the rôle of lymphocytes as a factor in the protection of guinea-pigs against tuberculous infection.

The author was unable to hasten the progress of the tuberculosis appreciably by exposure of the guinea-pig to massive doses of the roentgen ray.

The leukocytes of the blood stream are markedly reduced in number by exposure to the roentgen ray. The reduction is proportionate to the length of exposure with a given current and voltage. The lymphocytes are most markedly affected.

The cells of the tubercle are probably derived both from the local tissue and the blood. The presence of the usual number of epithelioid and large mononuclear cells in the tuberculous lesions of roentgenized guinea-pigs, where there is a marked diminution of lymphocytes, indicates that these cells are not of lymphocytic origin. The presence of an excess of lymphocytes in and around the blood vessels near the tubercles in non-roentgenized animals indicates that cells are carried to the lesions by the blood stream.

SITTENFIELD, M. J. New Roentgenotherapy in Cancer (*J. Am. M. Assn.*, January 8, 1921.)

The writer reports methods of *x*-ray therapy used in three German clinics visited by him last summer. He states that they are using voltages of 200,000 to 220,000, tubes having been developed to permit this. With this high voltage, short waves are produced in sufficient quantity to permit using heavy filters and still have enough of an almost monochromatic radiation left to be of practical value, and its physical characteristics have been determined suffici-

ently well to know the amount of radiation in tissues at various depths. He stated that in passing through 10 cm. of soft tissue, only 70 per cent of the total radiation reaching the skin has been absorbed, thus permitting 30 per cent plus scattering to be effective in tissue of that depth. So he estimates that 40 per cent of an erythema dose can be administered to a uterus of the average patient without injury to the skin, and that by using four ports of entry, namely, front, back and two lateral, approximately a full destructive dose can be so given.

Summarizing, he says that the lethal dose for carcinomatous tissue is 90 per cent of the skin erythema dose, that for sarcoma 70 per cent, for ovary 25 per cent. Fibromyomata respond to one treatment, resulting in complete castration.

Carcinomata of the breast is not so situated as to permit of receiving approximately equal amounts of ray in front and behind. Here, though, the tumor is rarely more than 5 cm. from the skin surface; so by increasing the skin-target distance to 70 to 90 cm., 85 per cent to 90 per cent of an erythema dose can be administered to the tumor without injury to the skin, as the effect is in inverse ratio to the square of the focal distance. The time required is 320 to 535 minutes.

The technique as reported for uterine cancer in Bumm's Clinic in Berlin is to ray four areas, one in front, one from behind, and one from each side, using a voltage of 190,000 to 200,000. The skin-target distance is 30 cm., and with a filter of 0.8 mm. of copper for ninety minutes over each area. Blood transfusion follows this treatment.

At Seitz and Wintz's Clinic in Erlangen, six or seven fields are exposed, using 23 cm. distance, 16 inch parallel spark gap, 0.5 mm. of copper or zinc filter for thirty-five minutes each area. This treatment is given in two "sittings" at six weeks' interval.

At the Opitz Clinic of Freiburg, the focal distance is 50 cm. Four ports of entry are used and each rayed for 120 minutes. Astonishingly good results are obtained.

EUGENE V. POWELL.